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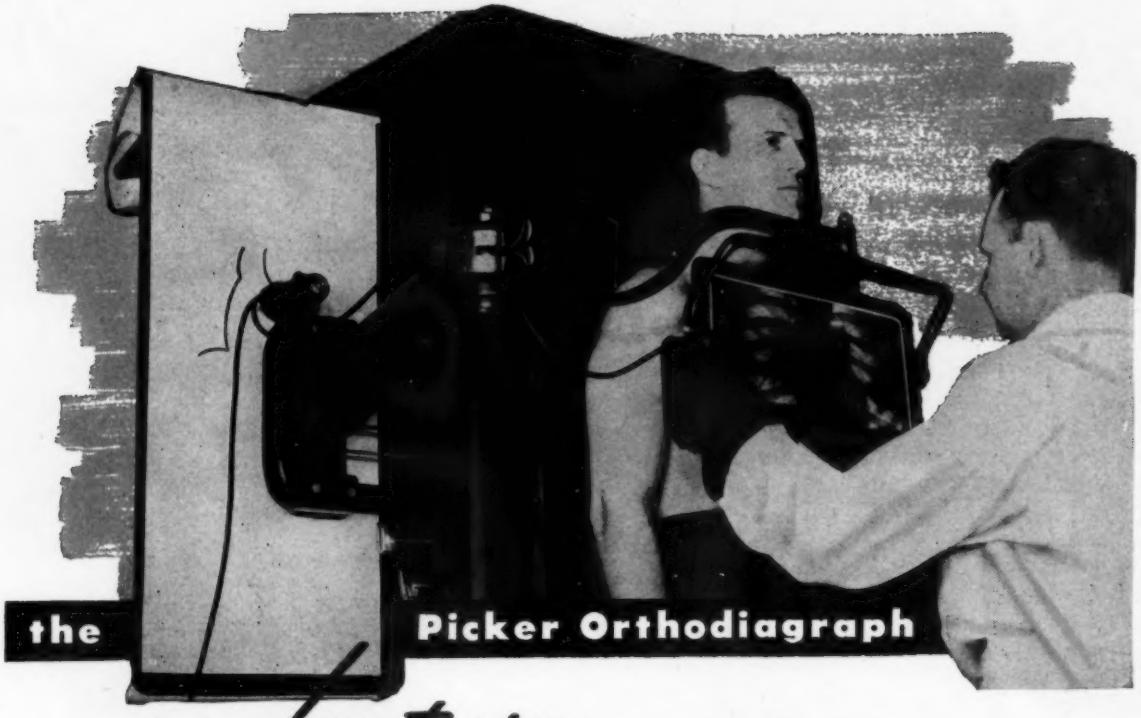

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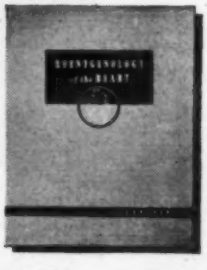

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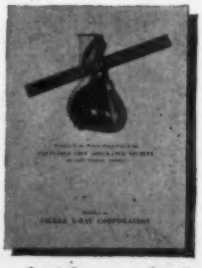

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DR. EDWARD E. DART has resigned his position as director of industrial hygiene for the Chrysler Corporation Medical Department in order to establish a practice in occupational medicine. This move marks the beginning of another phase of a continuing plan, conceived while he was a senior in medical school, and aimed at a career in industrial medicine in California. He has recently announced the opening of his practice limited to occupational medicine and the establishment of the Pacific Industrial Hygiene Laboratories, Suite 415 at 354 Hobart Street, Oakland 12, California. DR. DART is a native of the West, born at

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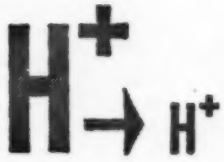

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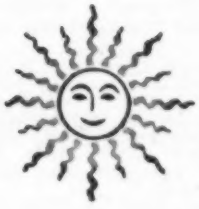

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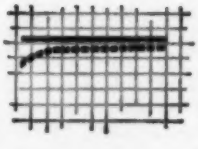

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Upland, California, in 1912. He graduated from Stanford University in 1934, received his medical degree from Stanford University School of Medicine in 1940, and his M.P.H. degree from Harvard School of Public Health in 1942. He began work in industrial hygiene in 1940 as medical officer in the Industrial Hygiene Division of the California State Health Department, and was subsequently director of the Industrial Hygiene Division of the Los Angeles City Health Department. In 1943 he joined the Chyrsler Medical Department as chief physician for the Dodge Chicago Plant. Division of Chrysler Corporation. Motors for B29 planes were made here; this was one of the largest individual plants in the country. At the close of the war, he was appointed director of industrial hygiene for the Chrysler Corporation Medical Department, with headquarters in Detroit.

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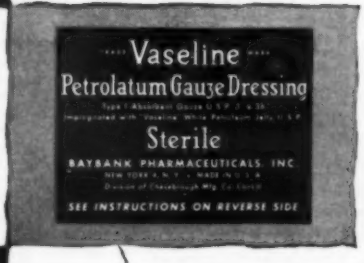

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MEAT
And the Surgical Patient

New knowledge regarding the significance of protein imbalance in the presence of surgical affections has profoundly influenced the management of the surgical patient.

Many conditions calling for surgery, such as peptic ulcer, cancer of the gastrointestinal tract, affections of the biliary tree, or bowel obstruction, may lead to protein imbalance. Severe burns and major traumas usually are associated with considerable protein loss. The operative procedure, intended to correct the situation, initially only adds to the protein drain.

The protein-deficient patient is always a poor surgical risk, predisposed to shock and more vulnerable to infection and other complications. Gastrointestinal anastomoses, for instance, may fail to function properly because of edematous occlusion of the stoma. Healing may be seriously impaired and convalescence delayed.

To make the patient a better risk, and to accelerate recovery, diets high in biologically complete protein are now routinely instituted before elective surgery is undertaken. Convalescence appears to progress better when a high protein diet is speedily resumed postoperatively.

Protein losses or deficiencies should be corrected by oral feeding of natural foods whenever feasible.

Meat, an excellent, highly digestible source of biologically complete protein, is particularly desirable in the patient's diet. It is usually well tolerated before surgery and can be given after surgery as soon as solid foods are permitted.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

American Meat Institute

Main Office, Chicago...Members Throughout the United States

This Metabolic Burden Should be Avoided

That persons who eat an inadequate breakfast or skip breakfast entirely find difficulty in obtaining their needed nutrients from the other two meals of the day is becoming increasingly apparent. A nutritionally unsound breakfast thus imposes an unnecessary burden not only on the other two meals, but also upon the organism.

For this reason, nutritionists are unanimous that breakfast should provide from one-fourth to one-third of the day's caloric and nutrient needs. In planning a nutritionally sound breakfast, a widely endorsed basic breakfast pattern serves well as the nucleus around which the morning meal can be built. Providing fruit, cereal, milk, bread and butter, this pattern supplies virtually all essential nutrients in balanced proportion. It is economical and readily available in all communities. The cereal serving, consisting of hot or ready-to-eat breakfast cereal, milk, and sugar, is an important main dish of this meal. It adds significant amounts of essential nutrients and makes possible wide variety because of the many kinds of cereals available.

The table indicates the nutrient values of this basic breakfast and the contribution made by 1 ounce of ready-to-eat or hot cereal* (whole grain, enriched, or restored to whole grain values of thiamine, niacin and iron), 4 ounces of milk and 1 teaspoonful of sugar.

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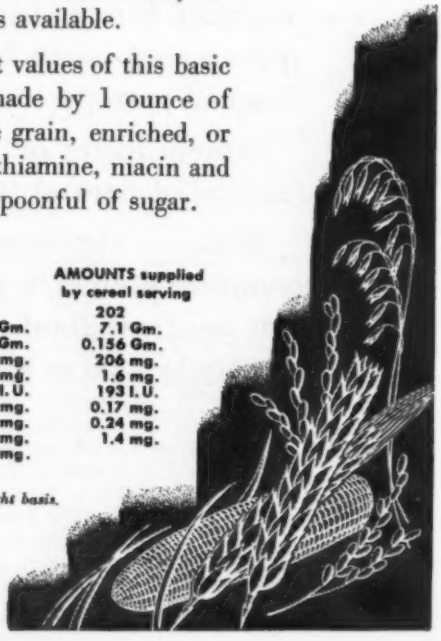
BASIC BREAKFAST	TOTALS supplied by Basic Breakfast	AMOUNTS supplied by cereal serving
Orange juice, 4 oz.;		
Ready-to-eat or Hot Cereal, 1 oz.;	CALORIES..... 611	202
Whole Milk, 4 oz.;	PROTEIN..... 20.7 Gm.	7.1 Gm.
Sugar, 1 teaspoon;	CALCIUM.....0.465 Gm.	0.156 Gm.
Toast (enriched, white), 2 slices;	PHOSPHORUS .... 488 mg.	206 mg.
Butter, 5 Gm. (about 1 teaspoon);	IRON ..... 3 mg.	1.6 mg.
Whole Milk, 8 oz.	VITAMIN A..... 1074 I.U.	193 I.U.
	THIAMINE..... 0.52 mg.	0.17 mg.
	RIBOFLAVIN..... 0.87 mg.	0.24 mg.
	NIACIN..... 2.3 mg.	1.4 mg.
	ASCORBIC ACID .. 64.8 mg.	

**Composite average of all breakfast cereals on dry weight basis.*



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A research and educational endeavor devoted to the betterment of national nutrition.

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Custom-made clots are now available with Gelfoam.*

The old surgeon may have dreamed of the day when a ready-made clot would staunch oozing surfaces, capillary bleeding, trickling from small veins, hemorrhage from resected tissues.

The surgeon of today has at hand a custom-made clot with GELFOAM, the absorbable hemostatic gelatin sponge. Cut or molded to the exact specifications of any wound, and applied with or without thrombin, GELFOAM may be left in situ without fear of tissue reaction.

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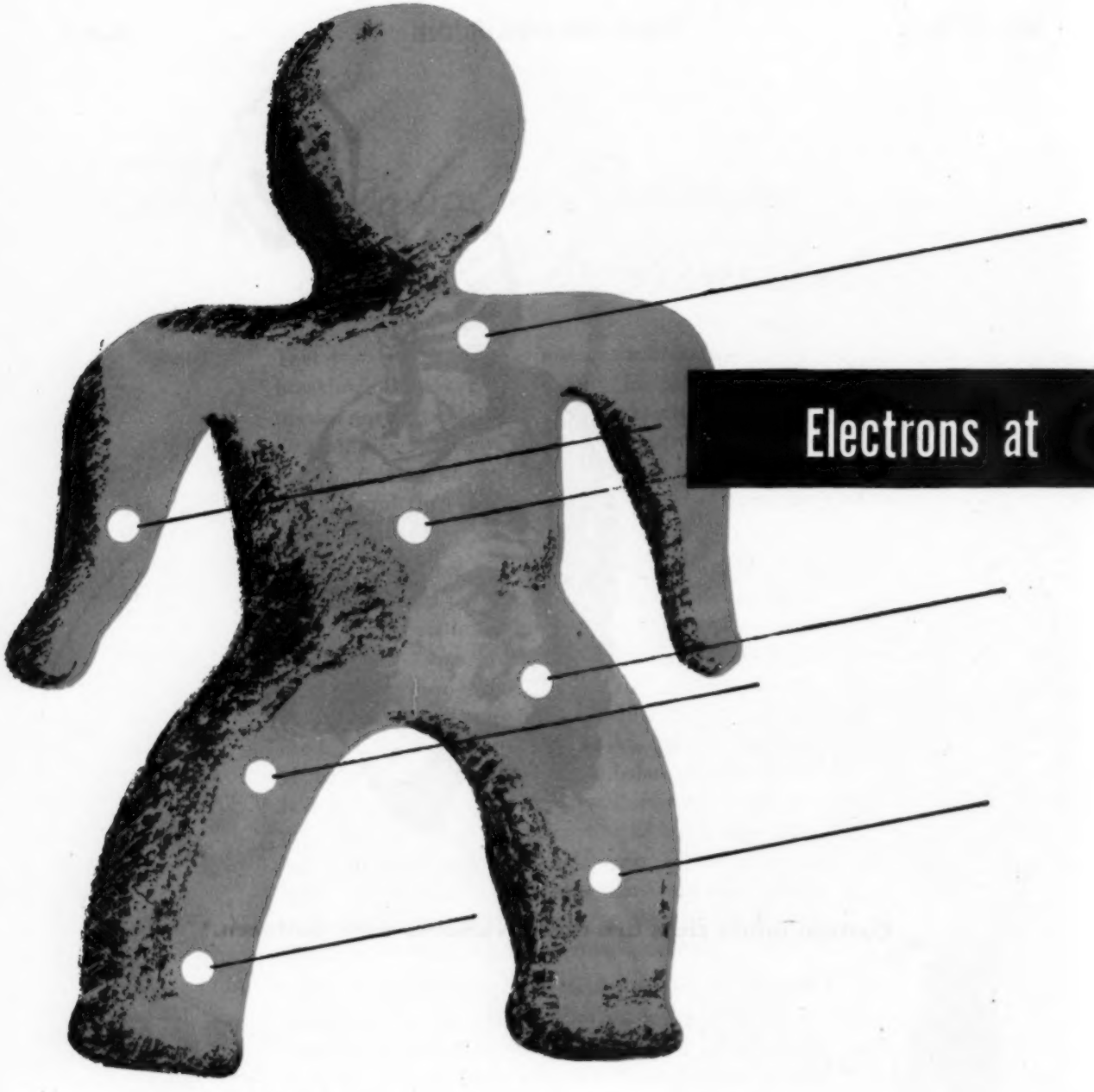


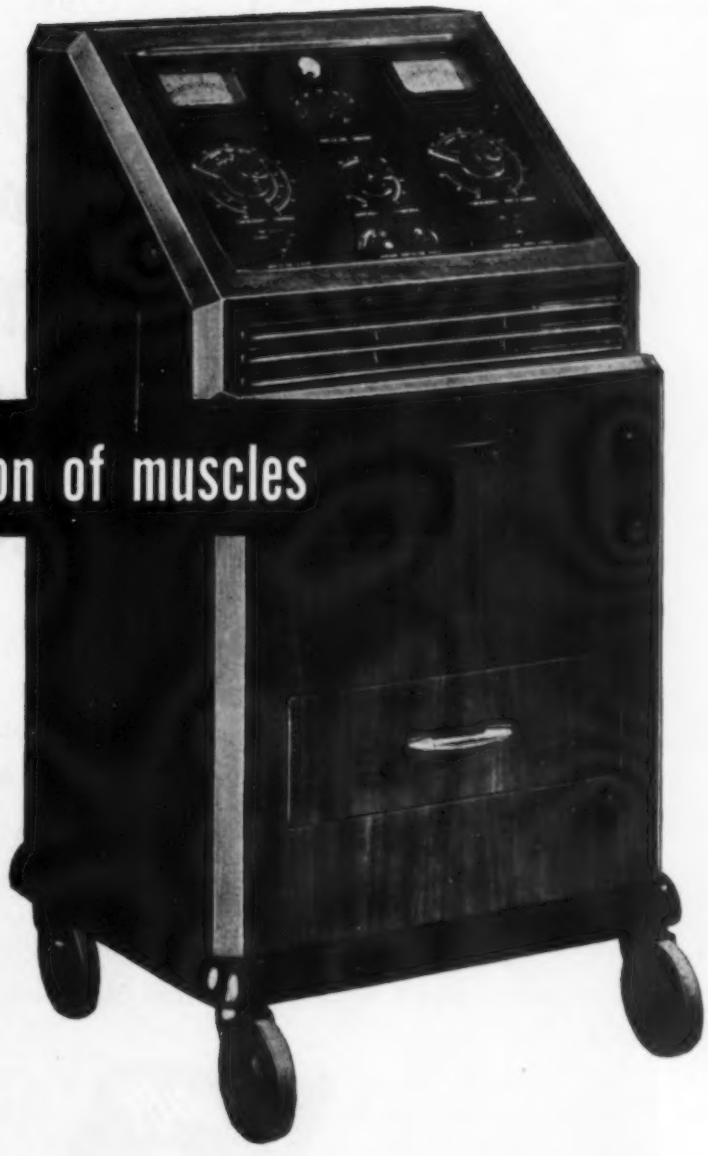
Electrons at

From the infinitudes of the electron comes a new force for healing. Smoothly, painlessly, muscles are now made to work their way back to useful activity.

It is natural that you should look to General Electric X-Ray for such advances. For G. E. has long shaped the forces of electronics to the uses of medicine. Coolidge tube, Inductotherm, the million-volt x-ray therapy unit work busily today, and predict new G-E achievements tomorrow.

General Electric leadership has brought to medicine the finest in x-ray and electromedical apparatus. The G-E emblem on any equipment is assurance that you can own no better.

work–in the restoration of muscles



The Rocke Hydrotherapy Bath is a compact, self-contained, mobile unit for the therapeutic application of whirling, aerated water. No plumbing is needed. No heater is necessary. For more information write to General Electric X-Ray.

G-E Variable Frequency Wave Generator for full-range stimulation of muscles

The electrical stimulation of muscles has been a subject of extensive research. Recently medical science has realized the need for new approaches and new apparatus.

The G-E Variable Frequency Wave Generator is the contribution of G-E engineers to this important field. It provides a range of frequencies from 2 to 6000 per minute. By selecting the proper stimulating frequency and contraction frequency, it is possible, with relatively little discomfort, to produce smoothly graded tetanic contractions in denervated muscles. This can be done regardless of the degree of degeneration except when muscle tissue has been replaced by fibrous tissue.

The control system, which may be adjusted while the patient is in the circuit, is simple to operate. The attractive walnut cabinet is designed to provide easy access to the control panel while in use.

There is an interesting illustrated folder which tells the story of this new G-E apparatus. It is yours for the asking. General Electric X-Ray Corporation, Dept. F-9, 4855 McGeoch Ave., Milwaukee 14, Wisc.

GENERAL ELECTRIC X-RAY

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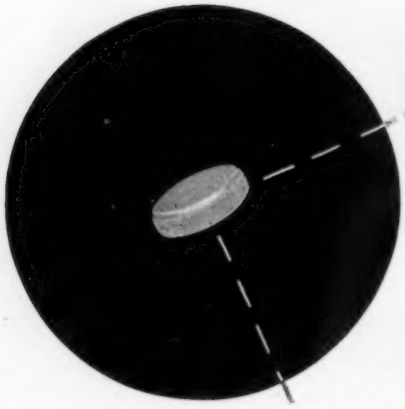

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Oropharyngeal infections respond well to intensive topical penicillin therapy. For effective treatment Penicillin Potassium Troches Winthrop-Stearns are now available in 10,000 unit strength in a slowly dissolving, pleasantly flavored base.

Average dose: 1 troche dissolved in the mouth every one to four hours and just before retiring. Supplied in vials of 12.

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Use the SAFEST antihistaminic first . . .

Neohetramine

"Clinically, Neohetramine has an advantage over all other antihistaminics investigated, in that it is *extremely well tolerated*, and may often be used successfully in patients who are unable to take other drugs of this series because of unpleasant side actions."

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Trial-and-error is the watchword in prescribing antiallergic drugs. Idiosyncrasies of the patient make it difficult to foresee which antihistaminic will afford the greatest symptomatic relief—or cause the lowest incidence of side effects.

Therefore, try the *safest* antihistaminic *first*.

***Dosage:* 50 to 100 mg. three or four times a day, preferably after meals and at bedtime.**

Neohetramine

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N, N-dimethyl-N'-p-methoxybenzyl-N'-(2-pyrimidyl) ethylenediamine monohydrochloride, made by Nepera Chemical Co., Inc.

25, 50, and 100 mg. tablets, bottles of 100 and 1000

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NEWS

DR. LOUIS SCHWARTZ, formerly Chief, Section of Dermatology, U. S. Public Health Service, announces the opening of his office at 915 19th Street, N. W., Washington 6, D. C., Suite 713, for consultation on matters of occupational and other contact dermatoses.

DR. EDWARD E. DART has resigned his position as director of industrial hygiene for the Chrysler Corporation Medical Department in order to establish a practice in occupational medicine. This move marks the beginning of another phase of a continuing plan, conceived while he was a senior in medical school, and aimed at a career in industrial medicine in California. He has recently announced the opening of his practice limited to occupational medicine and the establishment of the Pacific Industrial Hygiene Laboratories, Suite 415 at 354 Hobart Street, Oakland 12, California. DR. DART is a native of the West, born at

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INDUSTRIAL MEDICINE

Volume 17 JUNE 1948 *Number 6*

Medical Problems Encountered in the Manufacture of American—Made Rubber

REX H. WILSON, M.D., GLENN V. HOUGH, M.D.,
and
WILLIAM E. McCORMICK,
Medical Division, The B. F. Goodrich Company,
Akron, Ohio

THE manufacture of synthetic rubber, preferably called American-made rubber, on an extensive scale is a recently developed United States industrial enterprise brought about by necessity during World War II. Since much of the early research and development prior to World War II was done in the Research Laboratories of The B. F. Goodrich Company, under the direction of Dr. Waldo Semon, the potential health hazards were brought to the attention of the Medical Division at an early date.

Manufacture of American-made rubber progressed to the extent that during the recent war the vital rubber needs of our allies as well as our own were largely supplied by American-made rubber.

Since the war practically every product previously made with crude rubber can be, or is, made with American-made rubber from synthetic plants scattered over the United States. In 1947, for example, half of this nation's record rubber consumption was American-made. In the production of American-made rubber, many chemical compounds are utilized. Some of these have been used in rubber manufacturing processes for a long period of time, and their chemical and toxicological properties are well known. Other compounds are new and very little has been written concerning them.

Mallette[2] in 1943 discussed industrial hygiene problems encountered in synthetic rubber manufacture, while a previous description of the health hazards encountered in the manufacture of synthetic rubber was made by Wilson[1] in 1944.

This paper deals with medical experiences encountered in the manufacture of the butadiene type American-made rubber. The ingredients known or suspected of causing health problems are discussed in some detail. The chemistry of certain compounds used as various catalysts and modifiers in the manufacturing processes is familiar, and since they are used either in small amounts or are not particularly toxic, they will not be discussed in this paper. Specific examples of these are: Dodecylmercaptan, rosin acid soap, hydrochloric acid, sodium sulfite, diisopropyl dixanthogen disulfide, soap, sulphuric acid, Glaubers salt, ferric sulfate, potassium persulfate, sodium chloride, phenyl beta naphthylamine.

The principal basic chemicals used in the manufacture of butadiene type American-made rubber are:

1. Acrylonitrile with a chemical formula of CH_2: CH CN.
2. Styrene with a chemical formula of C_6H_5 CH:CH_2.
3. Butadiene with a chemical formula of CH_2: CH CH:CH_2.

Acrylonitrile

CHEMICAL *and Physical Properties:*[23]

Acrylonitrile (vinyl cyanide), with a structural formula of $CH_2{=}\overset{\overset{H}{|}}{C}{-}C{\equiv}N$, is a colorless volatile liquid boiling at 77.3°C. It has an ethereal odor, and is partially soluble in water. It has a molecular weight of 53.06 and specific gravity of 0.806 (20°C).

Mode of Action and Symptomatology:

Exposure of various laboratory animals, including monkeys, to acrylonitrile[15] in amounts varying from 90 to 635 p.p.m. (parts of vapor or gas per million parts of air) demonstrates that the symptomatology of all animals, except guinea pigs, is that of a typical nitrile exposure. These symptoms include initial respiratory stimulation followed by rapid shallow breathing, slow gasping spasmodic abdominal type respirations, generalized convulsions, coma and finally death. Biochemical studies[16] in this same group of animals showed that sodium nitrite in doses of 50 mg/kg of body weight exhibited a protective and antidotal effect when administered before and immediately after the animal's exposure. No signs of cumulative action were found in laboratory animals exposed to concentrations of 56 p.p.m.

Our own observations, on workmen handling cleaning operations in polymerizers with exposures varying from 16-100 p.p.m. for 20 to 45 minutes, show that the most frequent symptoms include dull headache, fullness in the chest, irritation of all mucous membranes including the eyes, nose and throat, a feeling of apprehension and nervous irritability. Some workmen complain of intolerable itching of the skin with no demonstrable dermatitis. When direct skin con-

tact occurs, it causes a direct irritation and erythema followed by bleb formation, desquamation and slow healing. Wilson[1] reported several cases of acrylonitrile poisoning that developed mild jaundice and low grade anemia and leukocytosis. Given orally the minimal fatal dose in laboratory rats is stated[14] to be 150 mg/kilo body weight. Symptoms in these animals included respiratory changes, cyanosis, convulsions and death.

Pathology and Laboratory Findings:

Pathological changes reported[16] in laboratory animals include hemosiderosis, indicating blood destruction, which was found to be proportional to the amount of exposure, renal irritation with hyaline casts in the straight collecting tubules, subacute interstitial nephritis and occasionally a subacute bronchopneumonia. Medical observations in industries where acrylonitrile is used have noted some evidence of liver and kidney irritation in employees, which cleared up promptly on removal from exposure. The probable range of exposure in these cases varied between 15 to 100 p.p.m. Cephalin flocculation, blood cholesterol, urinalysis, blood pressure, and the blood non-protein-nitrogen content are valuable tests in determination of liver and kidney damage associated with nitrile exposure. Four workmen exposed to acrylonitrile in cleaning operations of polymerizers in our plant were checked to determine blood thiocyanate levels in relation to nitrile exposure. The concentration of acrylonitrile in these polymerizers ranged from 16 to 109 p.p.m. With exposure to concentrations of acrylonitrile up to 22 p.p.m. for 30 minutes, the blood thiocyanate level was normal when determined 2½ hours after exposure. When the exposure was 50 p.p.m. for 30 minutes, the blood thiocyanate level had not returned to normal after 12 hours removal from exposure. These findings suggest that the amount of nitrile accumulated in the body even in minimal exposures is not easily eliminated and the detoxification capacity of the body is easily exceeded. These findings correlate with animal experimentation in which it was found that only one-third of the lethal dose of acrylonitrile is destroyed in the following 24-hour period after exposure.

Determinations in Small Amounts in Air:[14,19]

This can be carried out by exercising the principle that acrylonitrile under proper conditions can be converted to ammonia and acrylic acid. The reaction proceeds stoichiometrically so that one molecule of acrylonitrile yields one molecule of ammonia. Ammonia is determined either by titration[19] or colorimetrically.[14]

Treatment:

Because of its mode of action, patients with acrylonitrile poisoning should receive immediately the following routine treatment for cyanide poisoning:

1. Break an amyl nitrate ampule in a handkerchief and hold it directly under patient's nose for 20 seconds every three minutes.

2. In cases where poisoning is induced by oral ingestion, lavage stomach with a solution composed of 52 gm. of sodium thiosulphate dissolved in a liter of water.

3. Inject intravenously 10 cc. of 3% aqueous solution of sodium nitrite at rate of 2-5 cc. per minute, then 50 cc. of 36% solution of sodium thiosulphate.

4. Give artificial respiration if necessary.

5. Oxygen may be given by mask or nasal catheter.

When signs of poisoning persist or reappear, the sodium nitrite and thiosulphate may be repeated, using half the quantity originally used. In any case a second injection of the antidotal solutions (using ½ the original quantities) may be given two hours later for prophylactic purposes.

Vitamins B_1 and C have been beneficial in preventing weight loss to laboratory animals exposed to acrylonitrile over long periods of time.

Prophylaxis:

Atmospheric concentrations should not exceed 20 p.p.m. This necessitates enclosure of processes to the maximum degree possible and the effective use of mechanical exhaust ventilation. Skin contact should be avoided, not only because of the compound's vesicant action, but also because of possible toxic systemic effects. In the case of skin contact with the concentrated compound, immediate washing with copious quantities of soap and water is necessary. If spilled on the clothing, the clothes should be immediately removed and a shower taken by the individual. The effect of chronic low-grade atmospheric or skin exposures on humans is still undetermined. It is, therefore, advisable that working personnel be given periodic physical examinations, with special emphasis on hematology and liver and kidney functions. The determination of the thiocyanate level in both blood and urine has been sugested as an index of overexposure.

Styrene (Monomeric)

CHEMICAL *and Physical Properties:*

Styrene (phenyl ethylene, vinyl benzene) is a colorless liquid with a boiling point of 144.7°C. and a melting point of —31°C. with a characteristic disagreeable odor. Its structural formula is

Mode of Action and Symptomatology:

In man, concentrations of 1,300 p.p.m. cause extreme eye and nose irritation. This symptom, complex in itself, affords a definite safeguard against voluntary exposure to acutely hazardous concentrations. Laboratory animals[13] exposed for 12-hour periods to vapor concentrations of approximately 5,000 p.p.m. had symptoms of local irritation in the eyes, nose and mucous membranes, followed by primary effects on the central nervous system with incoordination, tremors, loss of equilibrium and finally, loss of consciousness. No other significant changes are

noted in laboratory animals given repeated exposures for periods varying up to six months with 650 p.p.m. In man, however, eye and nose irritation is marked at this concentration and could not be tolerated except for brief periods. A study of exposure of humans[17] indicated that in an atmosphere of 800 p.p.m. eye and mucous membrane irritation resulted, immediately followed by listlessness and sleepiness. After three hours exposure to this concentration, lack of muscular coordination and interference of equilibrium, depression, and weakness resulted. A metallic taste continued in most of the subjects long after interruption of exposure.

In experimental animals ingestion produces local irritation of the gastro-intestinal tract directly proportional to the amount ingested.

When styrene comes in contact with the skin directly, it produces an irritation and its dermatitis-producing qualities are comparable to that of the other hydrocarbons, such as benzene and toluene.

Pathological Changes and Laboratory Findings:

The outstanding pathological lesions encountered in tissue examination of animals exposed to styrene in varying concentrations are found to be pulmonary congestion, hemorrhage, edema and exudation. The degree of pathological involvement appears to vary directly with the amount of exposure. The kidneys and liver are affected as in any acute intoxication. Acute deaths in laboratory animals are central nervous system in origin. Delayed deaths are from pneumonia resulting because of initial lung irritation. Workmen exposed to 500 p.p.m. for varying periods of time presented no significant pathological changes and had no variation from the normal limits in chest x-rays or in laboratory examinations of urine and blood. A marked rise of total benzoic acid ranging from two to six times the normal (Quick method) has been reported[18] to have appeared in the urine of laboratory animals proportionate to the amount of styrene exposure. No hematological changes were noted in this same series.

Determination of Styrene in Air:[22]

Monomeric styrene can be quantitatively determined in the atmosphere by absorbing the vapors in a solvent (such as carbon disulfide, methyl alcohol, or ethyl alcohol). The amount of styrene present can be determined by either ultra-violet spectrophotometry, infra-red spectrophotometry, or nitration.

Treatment of Exposure:

Bed rest with general supportive and symptomatic treatment is indicated. A complete physical examination should be made with special emphasis on investigation of the respiratory system.

Prophylaxis:

The enclosure of all manufacturing processes, accompanied by necessary mechanical exhaust ventilation should be used wherever styrene is handled. Atmospheric concentrations should never exceed 400 p.p.m. and should be preferably maintained below 200 p.p.m. The former value has been tentatively established by the American Standards Association. However, there is good evidence to believe that concentrations at this level are too irritating to operating personnel for prolonged exposures. If skin contact occurs, with the concentrated compound, immediate washing with copious quantities of soap and water is necessary. If spilled on the clothing, the clothes should be immediately removed and a shower taken. Individuals working with styrene should be examined periodically. Hematological studies are of questionable value in low grade exposures.

Butadiene (erythrene, divinyl)

CHEMICAL *and Physical Characteristics:*

Butadiene is a colorless gas with an aromatic odor. It has a molecular weight of 54.09 and a boiling point of —4.7°C. The structural formula is $CH_2=CH—CH=CH_2$.

Mode of Action:

The passage of butadiene into the blood in vivo following inhalation is a process of simple diffusion of the gas from the alveoli of the lungs. It is rapidly eliminated in exhaled air without causing any significant pathological changes in the body, outside of its narcotic effect at very high concentrations.

Symptoms of Over Exposure:

Butadiene is practically innocuous aside from its narcotizing and anethetizing effect at very high concentrations. Human subjects exposed to 8,000 p.p.m. complained of eye irritation, blurring of vision, coughing, nasal congestion, and drowsiness.[17] Subsequent repeated exposures gave no indication of cumulative action. A complete examination of the chest including an x-ray, blood examination and urinalysis were not informative. Subsequent follow-up examinations were also negative. In laboratory animals[17] subjected to high exposures, irritation of all of the mucous membranes and the respiratory tract occurs along with varying degrees of narcosis. Acute deaths are due to pulmonary edema. Delayed deaths are due to chemical pneumonia following pulmonary irritation. Experimentation with butadiene in laboratory animals indicates that butadiene is not a safe general anesthetic because there is not complete muscular relaxation even in the fourth stage. Death ensues rapidly when the laboratory animal is kept in deep anesthesia for any length of time.

Pathology and Laboratory Findings:

No pathological changes or laboratory findings in the exposures of humans. No progressive changes have been reported in laboratory animals exposed to butadiene in concentrations of 600 to 6,700 p.p.m. for a period of 7½ hours per day, six days per week for eight months.[17] At the higher levels of exposure (6,700 p.p.m. or more) for the same period of time, some cloudy swelling was found in the livers of these animals. No significant changes in blood or urine

were found in any of the studies made on laboratory animals.

Method of Detection in Atmosphere:

Under proper conditions iodine pentoxide oxidizes butadiene completely with the liberation of 2.2 molecules of iodine. The amount of liberated iodine can be determined by titration with sodium thiosulfate.

Treatment:

Workmen anesthetized with or suffering from exposure to butadiene should recover completely, providing they are removed from exposure while respiration and heart action are still strong. Oxygen by inhalation should be administered until the pulse and blood pressure remain normal and the color is good. Symptomatic treatment in indicated.

Prophylaxis:

Of the three basic materials used in the manufacture of butadiene type American-made rubber, butadiene is the least toxic. Special precautions need to be observed in handling the compound from a fire and explosive standpoint. These include enclosure and mechanical exhaust ventilation and will in most cases automatically control the health hazard. There is no apparent systemic injury to humans in concentrations below 5,000 p.p.m. Any complaints which include eye and respiratory irritation, headache and vertigo might be considered as indicative of excessive exposure.

IN THE processing of butadiene-type American-made rubber into products, a number of chemicals are used. These include aromatic hydrocarbons, chlorinated hydrocarbons, petroleum distillates, ketones, acetates, alcohols and carbon disulfide. These compounds are all toxic in varying degrees and present certain medical problems in their handling. Specific methods for determining the atmospheric concentrations of these chemicals can be found in Jacob's[20] text.

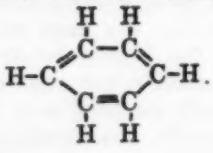
Aromatic Hydrocarbons

THE aromatic hydrocarbons are used extensively in the processing of American-made rubber. Of these, benzene (benzol, C_6H_6); toluene (toluol, $C_6H_5CH_3$); and xylene (xylol, $C_6H_4(CH_3)_2$) are the principal ones. These compounds are of value because of the fact that they are excellent solvents.

Benzene

CHEMICAL *and Physical Properties:*

Benzene is one of the most dangerous of the industrial solvents. It is a colorless coal tar distillate with a rather pleasant characteristic odor. It boils at 80.2°C and has a specific gravity of 0.879. The commercial varieties usually used in industry may contain from 2 to 10% toluene, xylene, olefine, paraffin, and carbon disulfide. The structural formula is



Mode of Action and Symptomatology:

As pointed out by Wilson[3] benzol poisoning may result from absorption of benzene by either the respiratory tract, the alimentary tract, or probably the skin. Cases of poisoning in human beings have been found with exposures to atmospheric conditions as low as 25 p.p.m. Concentrations of 50 to 100 p.p.m. are considered to be safe for the average person. Individual susceptibility varies. Acute benzol poisoning is rare. The symptoms of an acute case are referable to the central nervous system. There are muscular tremors, salivation, violent twitching, exhaustion, narcosis, paralysis, convulsions, and death from paralysis of the respiratory center.

Patients exposed to concentrations of vapors between 50 and 500 p.p.m., with the average concentration being about 100 p.p.m. show symptoms of lassitude, malaise, nausea, vomiting, dizziness, and headaches.[3] Macular dermatitis may appear. As exposure continues symptoms become more severe. Hemorrhages under the skin and from the body cavities may occur. In one case ecchymosis and petechiae were the first symptoms noted. At the time of appearance the blood count was normal. In five days the white blood cell count was 500. Diplopia, especially for close distances, occurs in some cases. If the person is highly susceptible, or if the exposure has been great and prolonged, he may get physiologic or functional depression of the bone marrow. This varies in degree from a slight hematopoietic suppression to a total bone marrow aplasia.

The symptoms of a total aplasia are usually those of benzol absorption followed by prostration. On the other hand, it is sometimes strange how well the patient may appear. Aside from fatigue there may be no other complaints.

The best index of benzol absorption is the blood count. All components of the blood are affected, being lowered. Most important, the total leucocyte count falls. Special reference should be made to the differential count. The ratio of polymorphonuclear cells to monocytes is changed. The number of monocytes increases and the polymorphonuclear cells decrease. The red blood cell count is lowered. The hemoglobin usually falls. It has been reported by some investigators that the leucocyte count may be elevated at first. However, when this occurs it is quickly followed by a general lowering of the count. The platelet count is lowered, dropping to practically zero in severe cases. The reticulocyte count is also lowered. The prothrombin time is normal. The resulting picture is one of aplastic anemia. One patient exhibited a count of 125 white blood cells, 1,500,000 red blood cells, and 25% hemoglobin. This patient died with bronchopneumonia. The red blood cells exhibit anisocytosis, poikilocytosis, and polychromatophilia. In all patients showing a marked blood reduction, a bone marrow biopsy should be done. The degree of aplasia can be determined, and usually an accurate prognosis can be made. Patients with total aplasia usually die. Patients with

partial aplasia have a prognosis dependent upon the amount of regeneration present. Urine examinations are usually negative. The blood pressure may be lowered.

Aplastic anemia is to be differentiated from agranulocytosis and acute leukemia. The symtoms of all of these diseases are very similar. In agranulocytosis the red blood cell and platelet counts are usually essentially normal. In acute leukemia the white blood cell count may be normal, raised, or lowered with the differential count showing a marked increase in very young white blood cells. The liver and spleen are usually enlarged in acute leukemia and are normal in aplastic anemia and agranulocytosis. The lymph nodes are normal in aplastic anemia and agranulocytosis and are usually enlarged in leukemia. Sore throat is common in leukemia and especially so in agranulocytosis. It must be recognized that the differential diagnosis between these three diseases may be difficult. Bone marrow studies usually reveal the proper diagnosis.

Treatment:

In patients with mild benzene intoxication, with or without a change in the blood count, the treatment is permanent removal from exposure. These patients will return to normal in a few days with no medication.

In patients, where absorption is sufficient to cause a marked change in the blood picture, more active treatment is necessary. These patients are placed at absolute bed rest. Multiple small whole blood transfusions (about 250 cc.) are given as often as once daily. One patient was given 50 transfusions, another 36. The patient may be alkalinized with sodium or potassium citrate. When severe reactions occur, blood plasma may be used in place of whole blood.

Direct bone marrow transfusions may be given as often as twice weekly. In this procedure 2 to 5 cc. of bone marrow are removed from the sternum of a compatible donor and introduced directly into the sternum of the patient. From the same donor 250 cc. of blood are drawn and transfused into the patient. This is followed by 1,000 cc. of normal saline solution.

Ten milligrams of liver are given intramuscularly daily. Large daily doses of liver, iron, calcium, phosphorus, yellow bone marrow, and multiple vitamins are given by mouth. A total of 400 to 600 mg. of ascorbic acid are given daily by mouth. A full diet is prescribed. The patient's general hygiene is improved as much as possible. Bleeding areas are stopped if at all possible. Pentnucleotide has been used and found to be effective in some cases.

The poor resistance in these patients is due to the lowered leucocyte count. Secondary infection, the most common of which is a Vincent's organism infection of the mouth, is one of the causes of death. For certain types of severe secondary infection sulfadiazine and antibiotics are indicated.

The response to therapy is slow since a considerable time is necessary for the bone marrow to regenerate. One patient was under treatment for twelve months, at which time he still had a low hemoglobin and red blood cell count. Splenectomy may be considered in some refractory cases. Any treatment, at best, is not wholly satisfactory. Extreme caution must be observed in the handling of this compound. In too many patients the disease proves fatal.

Prophylaxis:

Prophylaxsis is discussed at the end of this section on aromatic hydrocarbons.

Toluene

CHEMICAL *and Physical Properties:*

Toluene is a colorless, highly refractive inflammable liquid obtained from tolu and other resins, and from coal tar. It boils at 110.4°C. and has an odor somewhat similar to that of benzene. It is insoluble in water and is miscible with alcohol, ether, chloroform, carbon disulfide and petroleum benzine. Its specific gravity is about 0.865 at 25°C. Its structural formula is .

Toluene constitutes two to 10% of commercial benzene. It is used extensively in the rubber, lacquer, and munition industries.

Mode of Action and Symptomatology:

As pointed out by Wilson[4] the pathologic manifestations of exposure to toluene are a matter of controversy. The conclusions reached by various authors are in decided variance with one another.

Toluene poisoning is probably caused by absorption through the respiratory system, the skin, and the alimentary tract. The absorbed vapors exert a progressive depressant action on the central nervous system and the bone marrow. Toluene is also a pronounced irritant to mucous membranes. A factor to be considered whenever it is employed is individual susceptibility. Exposure to concentrations of toluene from 200 to 500 p.p.m. for six to eight hours will in most persons cause tiredness and lassitude. Concentrations over 500 p.p.m. for one to three hours are definitely dangerous and will cause symptoms attributable to depression of the central nervous system and the bone marrow.

Treatment:

Toluene may be assumed to be a dangerous chemical. Definite precautions should be taken whenever it is used. The treatment of toluene poisoning is the same as that of benzene poisoning.

Prophylaxis:

Prophylaxsis is discussed at the end of this section on aromatic hydrocarbons.

Xylene

CHEMICAL *and Physical Properties:*

Xylene is a colorless liquid with a mildly irritating odor somewhat similar to that of gasoline. It is insoluble in water and miscible with most organic solvents. It boils in a range from 138°C to 144°C. Its specific gravity is approximately

0.870 at 20°C. The commercial grade of xylene is a mixture of the ortho, meta, and para isomers and usually contains as an impurity small quantities of benzene and toluene. The formula of xylene is $C_6H_4(CH_3)_2$.

Mode of Action and Symptomatology:

Xylene is stated to possess more severe narcotic properties than benzene. Xylene poisoning is relatively uncommon because its volatility is lower than that of benzene or toluene. Chronic poisoning does occur. There is some evidence that xylene exerts an action on the blood forming organs similar to that of benzene. Cases of aplastic anemia have been attributed to xylene vapors. There have been some cases reported in German literature of leukopenia and thrombocytopenia with no reduction in red cells.

Treatment:

The treatment of xylene poisoning is comparable to that of benzene poisoning.

Prophylaxis of Aromatic Hydrocarbons:

Atmospheric concentrations should not exceed the values shown in Table I. In order to accomplish this, mechanical exhaust ventilation will, in most cases, be necessary. Skin contact should be avoided. Blood counts, including hemoglobin, red and white cell, and differential determinations should be made on all exposed personnel at least every three months. Sternal bone marrow examinations should be done on suspicious cases. Individuals with blood or bone marrow abnormalities should be considered for immediate and permanent transfer away from these solvents. Wherever possible, an attempt should be made to substitute less toxic solvents for the aromatic hydrocarbons.

TABLE I.
SUGGESTED MAXIMUM ALLOWABLE CONCENTRATIONS
(Parts per million parts of air)

Acetone	500
Acrylonitrile	20
Amyl (iso) acetate	200
Amyl alcohol	100
Benzene	100
Butadiene	5000
Butyl acetate	200
Butyl alcohol	100
Carbon tetrachloride	100
Carbon disulfide	20
Ethyl acetate	400
Ethyl alcohol	1000
Ethylene dichloride	100
Gasoline	500
Heptane	500
Hexane	1000
Propyl (iso) acetate	200
Propyl (iso) alcohol	400
Methyl alcohol	200
Methyl amyl ketone	200
Methyl ethyl ketone	200
Methyl isobutyl ketone	200
Naphtha (petroleum)	500
Perchlorethylene (tetrachlorethylene)	200
Propyl acetate	200
Stoddard solvent	500
Styrene	200
Tetrachlorethane	10
Tetrachlorethylene	200
Toluene	200
Trichlorethylene	200
Varsol	500
Xylene	200

Chlorinated Hydrocarbons

THE chlorinated hydrocarbons used in the manufacture of American-made rubber are:

1. Carbon tetrachloride (tetrachlormethane) CCl_4.
2. Ethylene dichloride (dichlorethane) $C_2H_4Cl_2$.
3. Tetrachlorethane (acetylene tetrachloride) $C_2H_2Cl_4$.
4. Trichlorethylene (ethylene trichloride) C_2HCl_3.
5. Perchlorethylene (tetrachlorethylene) C_2Cl_4.

Chemical and Physical Properties:

These compounds have varying uses. Some are used as solvents, others are used in fire extinguishers, as dry cleaners, degreasers, lacquer thinners, in the production of photographic film, and as anthelmintics. Their many uses are chiefly based upon their solvent properties and because some are non-inflammable.

Mode of Action and Symptomatology:

Most physicians are thoroughly familiar with the action of carbon tetrachloride on the human system and do not realize that the other members of the chlorinated hydrocarbon group are also extensively used in manufacturing processes.

The most toxic of the group is tetrachlorethane, having, according to Matruchot,[5] a comparative toxicity of 6.0. Carbon tetrachloride is listed by the same author as having a comparative toxicity of 2.6, trichlorethylene of 1.0, perchlorethylene of 1.4, and ethylene dichloride of 1.6. According to Davis[6] and the U. S. Public Health Service,[21] the maximum allowable concentration of carbon tetrachloride is 100 parts per million. According to Elkins[7] this level is too high and should be reduced to 50 parts per million.

The symptoms of over-exposure to the chlorinated hydrocarbons usually start with a feeling of drowsiness which, if exposure continues, is accompanied by anorexia, nausea, vomiting, abdominal pain, diarrhea, headache, and dizziness. Jaundice may develop. Oliguria progressing into anuria may also develop. In some cases bronchitis or bronchial pneumonia occurs, especially if free Cl or HCl is present. Some cases present hypertension. A constriction of the visual color fields has also been noted. Polyneuritis has been described. The mode of action is that of a narcotic with direct or indirect effects on the central nervous system. The chlorinated hydrocarbons also act as hepato-toxics, probably causing cirrhosis of the liver. This is especially noted when the diet has been deficient in calcium or there has been a depletion of body protein. The kidneys may be affected, the lesion being described as destruction of the epithelium with the stroma left intact. Hypertension and azotemia may accompany the kidney involvement. Clinton states[8] "that the renal injury is usually the predominant result of exposure to carbon tetrachloride. The lungs may be involved with either a bronchitis or bronchial pneumonia resulting, especially if free Cl or HCl is present." Acute

exposure to the chlorinated hydrocarbons is usually manifested by narcotic intoxication, with liver and kidney damage in six to 24 hours. The symptoms of chronic poisoning usually simulate those of portal cirrhosis.

Treatment:

A careful evaluation of the patient should be made including liver function tests, kidney function tests, electrocardiogram, and x-ray of the chest. Intravenous glucose should be given either in saline and distilled water. A high carbohydrate, high protein diet with a normal fat content is recommended. Methionine has been reported to be of benefit by some investigators. Others state that it is of no value. Choline has also been used. The patient should be kept under observation until all signs of liver and kidney damage have disappeared.

Prophylaxis of Chlorinated Hydrocarbons:

Workers should be carefully selected. The obese and the under nourished individual, nephritics, diabetics, individuals with lung and liver pathology and those having an enlarged thymus or thyroid should be rejected. Frequent physical inspections of exposed individuals should be made with particular attention being paid to kidney and liver function. Atmospheric concentrations should not exceed those listed in Table I. Mechanical exhaust ventilation is usually required to maintain these levels. Skin contact should be avoided.

Petroleum Distillates

CHEMICAL and Physical Properties:

Gasoline (unleaded), hexane, heptane, Stoddard solvent, Varsol, and naphtha are mixtures of hydrocarbons, paraffins, olefins, cycloparaffins (naphthenes), aromatics, and other impurities including sulphur. Cracked gasoline may also carry a fairly high percentage of benzol. These substances are frequently referred to by the general name of benzine. This is to be distinguished from benzene (benzol). They are colorless liquids with gasoline-like odors. They have varying boiling points ranging from approximately 70°C upwards. They are inflammable. The specific gravity varies from approximately 0.65 to 0.78. The volatility of these distillates is a factor in determining their toxicity for industrial use. The chemical formula of hexane is $CH_3 \cdot (CH_2)_4 \cdot CH_3$. The formula of heptane is $CH_3 \cdot (CH_2)_5 \cdot CH_3$. The others are mixtures with no single formula.

Mode of Action and Symptoms:

These distillates are narcotics, and it is possible to produce complete anesthesia with heavy doses. However, their anesthetic properties are much less than those of the aromatic and chlorinated hydrocarbons. For this reason they may be more desirable for commercial use.

Drinker and associates, in studying the effects of gasoline vapors,[9] found that concentrations from 270 to 500 p.p.m. were tolerable. Neuromuscular symptoms began at about 900 p.p.m. Mild intoxication at 2,600 p.p.m.

The susceptibility of humans varies greatly. Acute poisoning produces the symptoms of a narcotic. There is fullness of the head, headache, blurred vision, dizziness, unsteady gate, and nausea. The patient becomes irritable. Burning of the eyes, dimness of vision are common complaints. It is of interest to note that on exposure to air the symptoms become increased. Massive exposures may cause sudden collapse, coma, and death. In fatal cases there is usually some blood vessel damage with small hemorrhages into the organs. Bronchitis, lung edema, cellular damage of the kidneys, liver and the spleen have been described. The symptoms of chronic poisoning are usually central nervous system in origin. Epileptiform seizures, unconsciousness, tonic muscular spasms, lancinating pains in the limbs, coldness and numbness in the hands, loss of strength, loss of memory, drowsiness, dimness of vision, confusion and dullness of mentality, and tremors have all been described.

Degeneration of the pyramidal tracts have been described by Dorner.[10] The effect of chronic petroleum distillate poisoning on the blood is a matter of controversy. It is usually felt that the effect of gasoline fumes on the blood differs from that of benzene only in degree. It must also be mentioned that certain petroleum distillates are suspected of containing carcinogenic substances. At the present time considerable research is being performed along this line.

Treatment:

The treatment of acute petroleum distillate poisoning should be directed towards the prevention of respiratory and circulatory collapse. Following intense exposures pulmonary edema usually occurs. Oxygen therapy, preferably using a face mask and positive pressure, is indicated. Saturated clothing should be removed. Circulatory and respiratory stimulants may be necessary. Bronchopneumonia may develop. The antibiotics may then be necessary. Most of these patients are quite nervous and restless. Sedation may be indicated. Conjunctivitis may be treated by dropping 1:1,000 adrenalin solution into the eyes four times daily, followed by cold applications. Boric acid ophthalmic ointment may also be used. Iron medication should be given if an anemia develops.

The maximum allowable concentrations of gasoline have been stated to vary from 100 to 1,000 p.p.m. The values for these materials are indicated in Table I. These solvents are not considered to be severely toxic and in most cases the values are based more on personal comfort than on toxic requirements. Skin contact should be avoided.

Ketones

IN THE manufacture of American-made rubber, acetone (dimethyl ketone), methyl ethyl ketone (butanone), methyl isobutyl ketone, and methyl amyl ketone are used.

Chemical and Physical Properties:

The ketones are colorless, volatile, inflammable

liquids with a fruity-like odor. Their chemical formulas are: Acetone—$CH_3 \cdot CO \cdot CH_3$; methyl ethyl ketone—$CH_3 \cdot CO \cdot C_2H_5$; methyl isobutyl ketone—$CH_3 \cdot CO \cdot C_4H_9$; methyl amyl ketone—$CH_3 \cdot CO \cdot C_5H_{11}$. Their boiling points range from 56°C (acetone) to 152°C (methyl amyl ketone). Their specific gravities range from 0.79 to 0.82. They are useful because of their high volatility and solvent power.

Mode of Action and Symptomatology:

In our experience no cases of occupational disease have been attributed to the ketones. A narcotic action has been attributed to acetone when given to animals. It is known that when individuals are exposed to moderate concentrations of acetone, it may be found in the urine without clinical symptoms being noted. It is wise to suspect that the ketones have a narcotic action and may cause a depression of the body temperature, respiration and heart rate. Exposure to excessive atmospheric concentrations of most of the ketones results in severe optic and respiratory irritation.

Treatment:

Treatment is entirely symptomatic.

Prophylaxis:

Atmospheric concentrations should be maintained below the values given in Table I. Personal comfort is the determining factor as to the tolerable atmospheric concentration. Skin contact should be avoided.

Acetates

THE following acetates are used in the manufacture of American-made rubber: Methyl, ethyl, propyl, isopropyl, butyl, and isoamyl.

Chemical and Physical Properties:

The chemical formulas of the acetates are: Methyl—$CH_3 \cdot CO_2CH_3$; ethyl—$CH_3 \cdot CO_2 \cdot C_2H_5$; propyl—$CH_3 \cdot CO_2 \cdot CH_2 \cdot C_2H_5$; isopropyl—$CH_3 \cdot CO_2 \cdot CH(CH_3)_2$; butyl—$CH_3 \cdot CO_2 \cdot CH_2 \cdot CH_2 \cdot C_2H_5$; and isoamyl—$CH_3 \cdot CO_2 \cdot CH_2CH_2CH \cdot (CH_3)_2$. They are colorless, volatile, inflammable liquids. Their specific gravities vary from 0.87 to 0.92. Their boiling points vary from 57°C to 142°C. They have a mildly pleasant odor. They are used as solvents.

Mode of Action and Symptomatology:

This group of substances has an irritating action on the respiratory passages. They are also irritating to the eyes and may cause a slight narcosis. In general, the acetates are considered to be among the safest of the solvents. No cases have ever been reported of genuine acetate poisoning.

Treatment:

Treatment is entirely symptomatic.

Prophylaxis:

The suggested maximum allowable concentrations for these materials are shown in Table I (page 203).

These solvents are not considered severely toxic, and in most cases the values are based more on comfort than on toxic requirements. Frequently in rubber processing, the atmospheric concentrations can be adequately controlled by means of enclosure and natural ventilation. Skin contact may result in dermatitis and should therefore be avoided.

Alcohols

METHYL, ethyl, isopropyl, amyl, and butyl alcohol are all used in the manufacture of American-made rubber.

Chemical and Physical Properties:

Their chemical formulas are: Methyl—CH_3OH, ethyl—C_2H_5OH; isopropyl—$(CH_3)_2CH\ OH$; butyl—$C_2H_5CH_2CH_2OH$; and amyl—$C_5H_{11}OH$. They are colorless, inflammable, volatile liquids with characteristic odors. Their specific gravities vary from 0.79 to 0.81. Their boiling points vary from 65°C to 138°C. They are used as solvents.

Mode of Action and Symptomatology:

Methyl alcohol is a source of grave injury to many industrial workers. It has a specific action on the optic nerve, and with long enough exposure, blindness may result. The action is that of inflammation of the optic nerve followed by atrophy. A considerable amount of methyl alcohol poisoning was noted during prohibition days when wood alcohol was used in large amounts with subsequent optic nerve degeneration and blindness.

The other alcohols, because of their volatility are not considered to be especially dangerous. Cases of narcotic poisoning have been attributed to them but not proved. The higher alcohols, like butyl and amyl, have in addition an irritant action as well as some poisonous action on the protoplasm.

Treatment:

If methyl alcohol is taken internally, the use of an emetic is indicated. Four per cent sodium bicarbonate, as a gastric lavage, is excellent. When the toxic action results from absorption through the skin, a lavage is of no benefit Because an acidosis results, due to the formation in the system of formic acid from the methyl alcohol, sodium bicarbonate or sodium lactate intravenously is advisable. It can also be given by mouth. This treatment should be continued until the acidosis has been corrected. The patient should be kept warm and symptomatic treatment offered. With the exception of the eyes most abnormalities from chronic exposure clear up after removal of the exposure. The treatment of exposure to the other alcohols is entirely symptomatic.

Prophylaxis:

Atmospheric concentrations should be kept below the values shown in Table I. As with all solvents prolonged skin contact should be avoided. This is especially true of methyl alcohol, which can be absorbed through the skin in sufficient quantities to be harmful. Periodic physical examinations of personnel exposed to methyl alcohol should be made at two to three month in-

tervals. This should include an ophthalmologic examination.

Carbon Disulfide

CARBON disulfide has played an important part for many years in the rubber industry. Sulphur is incorporated into both crude and American-made rubber. It is also used in the manufacture of viscose rayon. It has long been recognized as an industrial poison.

Chemical and Physical Properties:

The chemical formula is CS_2. It is a colorless, highly inflammable liquid with a characteristic odor. The specific gravity is 1.26. The boiling point is 46°C. It is used as a solvent.

Mode of Action and Symptomatology:

The Pennsylvania Department of Labor and Industry[11] has done a complete series of clinical, anatomical, and experimental studies on carbon disulfide. Poisoning was found to be present even when exposure was not great. It was found that chronic carbon disulfide intoxication may involve all parts of the central and peripheral nervous systems beginning with psychic symptoms. Later peripheral neuropathy and damage to the cranial nerves, decrease of corneal and pupillary reflexes, as well as pyramidal and extrapyramidal signs occur. Varying degrees of Parkinsonism were also observed. The commonest form of carbon disulfide poisoning is neuritis which may affect any of the nerves but most commonly involves the nerves of the limbs and certain of the cranial nerves. Both the motor and sensory nerve fibers are affected causing abnormal sensations and loss of power. Pain is usually associated with these symptoms. The most striking and disastrous effects are upon the brain. The mental symptoms run the gamut from simple irritability and depression to manic depressive insanity. The most important point is the prevention of such poisoning.

Treatment:

There is no specific treatment for chronic carbon disulfide poisoning. A diet high in vitamin content with an adjunct of vitamin B complex may be of value. Liver extract may be given. For the acute case, five to 7% carbon dioxide in oxygen inhalations should be used along with respiratory and circulatory stimulants.

Prophylaxis:

This is one of the most toxic of industrial solvents. Atmospheric concentrations should not exceed 20 p.p.m. This necessitates the use of the compound in only those places where proper enclosure and ventilation can be provided. Its high volatility further adds to the control demands. Skin contact must be avoided. Periodic physical examinations, which include a careful evaluation of neurological symptoms should be made at monthly intervals on all exposed personnel. At the first intimation of any unusual symptoms indicative of carbon disulfide over-exposure, the employee should be removed from contact with the compound. The drinking of alcoholic beverages by exposed personnel should be discouraged.

Summary

THE principal ingredients of butadiene-type American-made rubber are enumerated and discussed. Toxicological properties, results of over-exposure, treatment of over-exposure and prophylaxis are described. An attempt has been made to review and coordinate the current literature with the author's personal experiences and observations.

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Arsine Gas Poisoning — Report of a Case

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THE following is written to aid future progress in the knowledge and treatment of arsine poisoning. The creation of arsine gas (AsH_3) in this instance, was carried on in a one-ton Heroult steel furnace, which contained drosses of calcium arsenide, calcium phosphide, and calcium carbide from a process treating manganese ore; and which had been inactive for a month. The employee manually cleaned the furnace by climbing half way through the firing door. He spent about three hours at the job.

MR. R. S., age 51, employed as an experimental furnace operator for 25 years, unwittingly exposed himself to furnace dust and/or arsine fumes on December 9, 1947. It so happened that a group including the patient was examined on the following day incidental to another industrial condition and at this time no clinical findings were revealed. Around noontime on December 11, 1947, the patient noticed generalized muscular aches in his legs and a mild epigastric bloating. He remained at work for the rest of the day and, upon returning to his home that evening, informed his wife that he did not feel sick enough to call a physician. Following a bowel movement that evening, a dark port-wine stain was noticed on his pajama front. A few hours later he voided port-wine urine. Following a rather fitful night, he awakened with the same generalized symptoms, felt slightly feverish, and had a generalized parboiled redness to his skin and an acute redness of his sclera.

I first saw the patient at noontime on December 12, 1947. He did not appear acutely ill at this time. There was a marked red-parboiled appearance to the skin which did not fade upon pressure, both sclera were injected and slightly icteric, his tongue was dry and coated, there was an indescribable metallic odor on his breath, his temperature was 101.2 orally, pulse was 86, blood pressure was 84/52 (his normal pressure was reported to range around 112/80), and a mild tenderness was reported in his mid-epigastrium. The rest of the examination was negative. The patient voided approximately 100 cc. of a viscous port-wine colored urine.

Patient was hospitalized that day. On admission, urinalysis showed that hemoglobin was present, specific gravity was 1.213, albumin was three plus, sugar was negative. Microscopic examination revealed an occasional pus cell and a few granular casts; guaiac test was four plus.

Blood examination was eight grams or 51.5% hemoglobin per 100 cc. 2,350,000 red blood cells and 14,450 white blood cells per cubic milliliter. The differential count was normal with the exception of the presence of 35% disintegrated polymorphonuclear cells. Patient was blood typed —R.H. positive, Type A. Icterus index was attempted, but because of the high met-hemoglobin in the blood serum, no reading could be made.

Patient's progress in the hospital was that of rapid renal failure during which, on December 14th, the urea nitrogen read 212.4 and the total non-protein-nitrogen was 264. The urine picture was not available because of an almost complete anuria. Blood picture fluctuated slightly in response to daily blood transfusions until December 15, when the red blood cells fell to 1,500,000, and the hemoglobin read 38.2% (6 grams). The white blood count was 17,000; the urea nitrogen, 160; and the total N.P.N. was 190. Approximately one and one half hours previous to death, urea nitrogen was 147; total N.P.N., 184; creatinin was 10; CO_2 combining power was 38.5; and the cephalic flocculation over a 24-hour period was positive.

DIAGNOSIS was not definitely established until after death. Dr. Steward Vaughn, hemotologist from Buffalo, saw the patient on December 12, 1947, and at this time made a tentative diagnosis of blood destruction due to a heavy metal poisoning — cause undetermined. Dr. Nicholas Ardan who was called in consultation gave the same diagnosis. After death, the anatomical diagnosis submitted by Dr. Wm. F. Jacobs, pathologist, was: (1) acute arsine poisoning with marked destruction of red blood cells, anoxemia, and anemia; (2) urinary suppression; (3) hemoglobinuria; (4) pulmonary edema.

Laboratory examination made for the presence of arsenic was negative in all organs, including the hair and fingernails, except the lungs which revealed 0.06 milligrams as As_2O_3.

TREATMENT of this case consisted of daily whole blood transfusions, fluids orally when tolerated, sodium bicarbonate — one gram every three hours for four doses, and 2000 cc. of 10% glucose in saline daily. Every four hours, 1.35 cc. of British Anti-Lewisite (B.A.L.) was administered intermuscularly. It was originally failure of improvement in the clinical picture, the planned to reduce the dosage, but because of a failure of improvement in the clinical picture, the drug was continued until death. Symptomatically, codein (grains,½), hot packs for sweating, and oxygen tent were administered. Terminally, because of the marked pulmonary congestion, 300,000 units of penicillin in oil and wax were administered in one dose and one ampul of synkayvite was administered just previous to death because of clinical evidences of hemorrhagic disease.

A FATAL case is described in which a workman unknowingly had a three-hour exposure to arsine gas while cleaning an experimental furnace. It is obvious, from the failure to recover arsenic in any body structure except the lungs, that all treatment in this case was in vain.

What Kind of Specialty is Industrial Medicine?

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THE HARD working and able secretary of this Western Association of Industrial Physicians and Surgeons, DR. CHRISTOPHER LEGGO, is plant physician in one of the world's largest sugar refineries. He recently showed some of us through his immaculate plant where we saw much of interest. The most intriguing process was the final crystallization of the sugar. An aqueous solution is boiled under partial vacuum for a long time. At precisely the right moment it is "shocked" into crystallization and an enormous vat of liquid suddenly turns to a veritable mountain of solid, crystalline sugar. In older times this "shocking" was called "striking" because it was brought about by striking the open, boiling cauldron with a hammer. Despite the best of skill, the "strike" was not always successful— it was boiled longer and struck again.

The cauldron of training industrial physicians has been boiling for sometime. Thus far it has produced only heat and steam.[1,2,3,4,5] I propose to "strike" it now to see if we can get even a few crystals of fact and agreement which will serve to tell us what the final product will be like. Some may be "shocked" by what I have to suggest. If it is not yet ready, let us build up the fires and boil it merrily some more!

Industrial Medicine is a Specialty

BY *industrial medicine*, I mean the whole range of medical art, science and skill applied to industry, including internal medicine, surgery, preventive medicine, and all the ancillary professional skills, such as engineering, chemistry, nursing, etc. By *industrial physician*, I mean he who intends to devote his career to this field.

There can be no doubt that industrial medicine has become another field of specialization in medicine. It requires long and arduous training, both academic and practical, over and above that obtained in medical school. It calls for more intimate knowledge of such sciences as physics, chemistry, physiology, pathology and toxicology, than is ordinarily needed by physicians. It demands considerable grasp of basic disciplines not usually taught in medical school, such as economics, engineering, business administration, statistical analysis and biometry, epidemiology—which is the mass phenomena of disease—public and personal relations, hygiene, educational methods, environmental sanitation and the like.

Finally, it requires a period of intimate association with one who is a master in the specialty, since only thus may the trainee learn by example the finer arts, the maturity of judgment and the personal qualities which make for success. These are the characteristics of the other specialties of medicine.

One of the characteristics of other specialties is lacking, however. This is a general agreement on the kind of training needed to produce the specialist in industrial medicine. This is the missing crystal which, once produced, will solidify the syrup. On it depends our recognition as a specialty, the organization of a specialty board, the improvement and perpetuation of our profession, and what is most important, better health for a large segment of our people.

How Do We Get That Way?

WHAT kind of specialty is industrial medicine, what is it like? We agree that those who function successfully as industrial physicians are specialists, but how do they get that way? Graduate courses in this specialty are few and far between and they are extremely varied. Few, if any, hospitals offer residencies in this specialty. Even if they did, the industrial physician is best trained in the factory, not in the hospital. But which industrial medical departments are suitable for practical and skilled training, and which are not? What shall we advise young physicians who seek adequate training and recognition in our specialty?

It would take a wiser man than I to answer all these questions, but I suggest the answer may be closer than we think. It has been my good fortune to be equally interested in industrial medicine and in public health for many years. During this time, both have developed into specialties in medicine.

Industrial Medicine and Public Health Similarities

WHEN we stop to look at it, there are surprising similarities between public health and industrial medicine.

PREVENTIVE MEDICINE: The physician actually working in the plant almost invariably becomes interested in prevention. As soon as the average doctor begins to see repetitious pathology, he automatically seeks a common cause. If a common cause can be discovered and eliminated, that is preventive medicine and public health. This is often, but not so universally, true of the physician who sees industrial cases in his office. Preventive medicine on a mass scale is public health. The plant physician or industrial director is frequently referred to as the health officer of the plant.

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ENVIRONMENT: Working and living conditions are one and the same, physiologically. The first concern of both the health officer and the industrial physician is with environment. Both must be certain that the air is pure with a temperature within physiological limits, that the water is pure, food safe, light unharmful, and that harmful wastes are disposed of properly.

FUNCTIONS: Both the industrial physician and health officer combine administrative and clinical ability. They cannot escape administrative work; they are always doctors. Most failure or lack of success stems from poor administrative skill, not from lack of medical knowledge. Administrative skill is not learned in medical school. It is probably never learned by some. But in those born with a spark of it, administrative ability can be developed by formal training and demonstration.

HETEROGENEOUS STAFF: Industrial physician and health officer alike must depend on staff members originating in other professions: engineers, chemists, laboratory personnel, nurses, educators, statisticians, accountants, and others. This requires respect for and understanding of the special skills of these related professions and how they may be teamed up with one another.

RELATIONSHIPS WITH MEDICAL PROFESSION: Regardless of size of staff, industrial physicians and health officers are constantly aware of their dependence on their medical colleagues in the community. Relationships with them are therefore of great importance and often determine major policies in the health department and in industry's health service.

A lifetime of training will not equip the industrial physician or the health officer to render all the specialized medical services his clients need. He may be the best of traumatic surgeons and at the same time have enough administrative skill to run an industrial medical department or a health department. But he will still have to refer special cases to the ophthalmologist, dermatologist, or internist. He may be an expert toxicologist or bacteriologist and still do a passable job of administration. But he still needs ready access to other specialists. The health officer hires, on a part-time basis, pediatricians for his well baby clinics, roentgenologists to read his miniature chest films for tuberculosis, orthopedists for his crippled children's program, ophthalmologists and otologists for his sight conservation classes and his hard of hearing groups. The industrial physician, too, must know when and what kind of specialists to seek and what to expect of them. But neither can possibly be trained enough to render all needed medical services. The one quality neither can do without is administrative ability. They must learn to engender teamwork toward the common goal among a heterogeneous staff and a variety of specialists. One of their major services to the medical profession is to interpret them to the public, assure them the respect to which they are entitled, and provide for them the best of working conditions during the hours they devote to industry and the health department.

FINANCIAL DEPENDENCE: Unlike the physician engaged in private practice, the industrial physician and the health officer depend on someone else for their financial support. The health officer must present his needs convincingly to the city council or other appropriating body; the industrial physician must convince management and sometimes labor of his needs.

GENESIS: Both public health and industrial medicine originated largely in the minds of physicians—farseeing men with broad interests in humanity as a whole, men who had the knack of applying consulting room observations to groups of people. To begin with these men were few and far between and were sometimes thought fools by their colleagues but, like the leaders of other specialties, they pioneered wisely and eventually earned the respect of their colleagues.

It is not so long ago that a physician devoting full time to industry was called a "contract doctor" and regarded askance by his medical society. Similarly, the health officer was often looked upon as a political doctor, too lazy or too clumsy to make his living in "legitimate" medical practice.

Nevertheless, both public health and industrial medicine have gradually developed special knowledge and skills of great credit to the medical profession and of much benefit to mankind.

LACK OF APPRECIATION: It is the irony of fate that the great advantages of both public health and industrial medicine remain largely unappreciated by those who benefit most from them. There are still all too few industrial physicians and too few health officers. We will overcome this together as we become more skilled and can demonstrate more widely our value.

DEPENDENCE ON COMMUNITY HEALTH FACILITIES: The able industrial physician is seriously handicapped in the absence of a good health department, and the health department is blocked if there are no suitable health programs in the industries of his community. Both are aided by the presence of good hospitals, doctors, schools and voluntary health agencies. Health and safety cannot be safeguarded in industry alone any more than in the public school alone.

TRAINING PROBLEMS AND SPECIALTY RECOGNITION: Here, too, industrial medicine and public health are following parallel courses, though public health has forged ahead with its training problems in recent years while industrial medicine has made a little more progress toward meeting the requirements for a specialty board.

Industrial medicine has succeeded in laying the ground work for fellowships or residencies

in hospitals combined with industrial medical departments.[6,7] If enough such combinations can present suitable evidence of their ability to train industrial physicians adequately, a specialty board will presumably be formed. But the plans are still nebulous. No one has made a job analysis of what the average industrial physician does, how much time he spends on his various functions and what skilled training is required for each of these functions. There are all types of industrial physicians from the part-time man whose contribution is limited to seeing workmen's compensation cases in his private office and who rarely visits the plants, to the full-time man with a large medical staff and commodious quarters in the plant. Industry provides varying degrees of medical care from first-aid only to complete care for employees and dependents. Industrial medicine has as yet no way of accrediting formal courses in schools or of medical departments in industry for field training of candidates. It will be interesting to see which hospitals and industries among those now applying to the Council on Medical Education and Hospitals of the American Medical Association are accepted and on what grounds. One wonders to just what extent additional hospital training really contributes to the skills required of the future industrial medical director, and how many hospitals have a large enough occupational medicine service to be really helpful to the trainee.

Public health on the other hand has advanced its training ideas and facilities remarkably in the last few years.[8] There are now nine schools of public health in this country and one in Canada fully accredited by the American Public Health Association. Accreditation is based on criteria carefully worked out by the Committee on Professional Education in collaboration with the deans of the schools.[9] A school is accredited only after it has been inspected by the Consultant on Accreditation and one other recognized authority. Criteria are revised upward periodically and accreditation is for one year only. Reaccreditation takes place only after the school's faculty and facilities have been re-examined. Last year, excluding nurses, there were 996 students enrolled in all schools for graduate degrees in public health. Six hundred sixty-nine degrees were granted.[10] So far as we know, with the exception of engineering, no unaccredited schools are granting graduate degrees in public health.

All schools expect field experience either before matriculation or as a final requisite to graduation. Field training centers are selected by the school and satisfactory performance is required of the candidate before the degree is granted. The Committee on Professional Education is now engaged in accrediting field training centers.[11]

Many physicians enter these schools for special training in one or another sub-specialty of public health; not all wish to be health officers. Those wishing to become directors of tuberculosis control take one semester of basic public health courses (described below) and in the second semester get special clinical training in tuberculosis diagnosis, bacteriology, therapy and control. Their field work is in a well run tuberculosis bureau. Those interested in venereal disease control get the semester of basic courses plus a second semester of special work in bacteriology, serology, therapy, case-finding and epidemiology. Those interested in maternal and child health get the same first semester plus a second semester in pediatrics and obstetrics. Those interested in industrial medicine are diverted to proper courses and field work in the second semester.

Training in Schools of Public Health

THE BASIC first semester courses for physicians in schools of public health are those needed by any medical man attempting to apply medical art and science to groups of people. They include such subjects as public health and medical administration, epidemiology, vital statistics,. environmental sanitation, health education and sometimes business administration or political science. They teach some of the fundamentals of administration. They explain the mass phenomena of health and disease, how to apply modern statistical methods when analyzing data, something about budgets and accounting, something about health education and public health nursing, a good deal about safeguarding water, milk, food, air, light, and waste disposal. They help orient the physician in the allied professions like education, engineering, nursing and business administration.

All accredited schools of public health have close affiliations with medical schools and hospitals—an essential for the wide variety of second semester elective work required by the special interests of physicians. Most of the teaching is in seminars or small discussion groups with ample opportunities for small research projects, special exercises and field trips for observation. After his three months field work, following the second semester, the physician is prepared to begin to exercise any administrative ability he has acquired. It will still take some years of experience to make him a top-flight administrator, but at least he is well drilled and started in the right direction. Experience shows that if he now gets an appointment with a well qualified senior, his development is rapid and gratifying. After one or two years of such experience in a well conducted health department or industrial medical department, the man should be ready for specialty board recognition.

Several schools of public health are now offering, or preparing to offer courses in industrial medicine. Why not encourage more schools of public health to provide facilities for the adequate training of physicians seeking careers in industrial medicine? Why not encourage young men seeking such training to apply to the schools of public health now offering it? I suggest that this will help crystallize the present nebulous training problem in industrial medicine. It will give us the advantage of benefiting from the

long experience with training problems in the public health field. This has been adopted at the Public Health Department of the University of Manchester (England) though they grant a slightly different degree to the industrial physician than to the health officer.

Most schools of public health, not already doing so, could arrange the essentials. Among them would be: Able and competent faculty; second semester intensive courses in: environmental physiology, toxicology and special hazards, medical administration in industry, health education methods suitable to industry, industrial hygiene laboratory work, emergency first aid and surgery; hospital administration, if desired; research problems and opportunities.

Conclusions

WE HAVE seen the remarkable similarity between public health work in general and public health work applied to industry. I submit that industrial medicine is largely public health work applied to industry.

It is true that many members of this association are primarily interested in treating the person injured in industry—so much the better. The more they study and understand the problems peculiar to the working environment, the better doctors and surgeons they become and the more help they are to industry. This association is a splendid forum in which to exchange our specialists knowledge with each other. It should continue to be a common meeting place for all who are interested in any phase of industrial health.

We are concerned here solely with the graduate training of those who wish to devote their full time to the administration of medical programs in industry. The training of specialists treating industrial cases is another matter. For the most part it is already well provided for in the various specialty boards, such as surgery, ophthalmology, dermatology, etc. The physician devoting his full time to industry is essentially a public health man and a medical administrator. He should, therefore, be primarily trained in public health and medical administration with sound knowledge of toxicology and special hazards.

He is a welll trained physician, competent to handle a general practice and aware of the conditions calling for specialists' attention. It is futile and misleading to try to prepare him to practice all the specialties of medicine in a factory or mine. He will always need the services of the qualified specialists in his locality; hence, why drill him in today's best method of treating a compound intra-capsular fracture of the femur? That treatment will be improved tomorrow, and tomorrow he may be confronted with an intra-orbital foreign body instead of a fracture anyway. No, he'd better learn what superior services he can expect from the specialist, then decide how much service he needs to purchase for his particular industry, and be trained to use them wisely for the mutual benefit of the specialists, wage-earners, and management.

I believe with a little encouragement from us, the public health schools are willing and capable, for the most part, to help solve this problem of training and specialty recognition.

Industrial medicine is probably not yet quite ready for a specialty board, any more than public health. But we will be ready when we can agree on the kind and amount of academic training our future members need, and on the kind and length of field experience they need. With a start already made by the Council on Industrial Health of the American Medical Association toward accrediting certain industrial medical departments, it should soon be a simple matter to prepare a list of suitable centers which would be acceptable to the Council on Medical Education and Hospitals in lieu of approved hospital residencies required of other specialty boards. With these accredited industrial medical departments, and the schools of public health ready to furnish the intensive academic intramural graduate work, the training problem might soon be resolved.

There is no intent in these suggestions to discredit or discourage those medical schools now offering adequate training in industrial medicine, but not presently connected with schools of public health. The fact is that many schools of public health originated as departments of the medical school. Some are still under the dean of the medical school. Departments of industrial medicine granting graduate degrees can be developed in the same way and accredited either by the American Public Health Association or some other suitable body.

Does this "strike?" If not, let the cauldron boil more!

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Skin
—The Fragile Element in Industrial Production—

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FOR OVER a decade, as a result of extensive medical, chemical and engineering studies, the worker has been adequately protected from metabolic poisons. Lead dust and fumes, mercury vapor, volatile solvents, and other known toxic substances, are today adequately removed from the work area. Systemic disease from industrial chemicals is a rarity at this time.

Similarly effective preventive measures for skin diseases, however, are not yet known. While protective creams and lotions, newer cleansing substances and the education of personnel are sufficiently advanced to effect some benefit to the worker, many eruptions still occur—and more preventive work must be done.

Of all the organs affected by industrial chemicals, none is so exposed as the skin. It, alone, is the common industrial denominator of the machine shop, plastics plant, shoe factory or millinery store. That it is the fragile factor in industrial production none can deny. Not only does industry suffer from the out and out industrial cases, but production also is adversely affected from the absenteeism due to nonindustrial eruptions. Thus key men, who lose time from scabies, barber's itch, athlete's foot or other eruptions, can so derange production that the whole plant suffers. If to this we add the lost time due to malingering, the fragility is all the more apparent.

Principles of Prevention

LET US review a few basic principles on the prevention of skin diseases. Emphasis should first be placed on the proper selection of workers. This is a problem for the personnel department—but it is also a medical problem as well, for the plant physician or consultant must tell the personnel department *whose skin is for what job*. Such information primarily is of value to the worker for he is the one who suffers most.

Applicants who, prior to employment, have had acne, allergic or atopic eczema, irritation from soap or paint or other serious skin diseases, should be carefully placed by the management.

Patients who have had poison ivy, especially repeated attacks of increasing severity, are especially prone to develop dermatitis from resins, paints, naphthas, and a host of similar substances. Recently, a trainee as a pressman was seen who had been working in a printing plant for but two weeks. After one week of work he had developed a vesicular eruption of the fingers and hands, presumably due to the naphtha or turpentine used for the cleaning processes in the press room. On questioning, he stated that for several years he had suffered from various eruptions—once due to turpentine used at home for cleaning his skin after painting, and for five years, each summer, from poison ivy. He had been hospitalized on two occasions for severe dermatitis of the hands, face and trunk. Surely, this boy, in justice to himself, was not a fit candidate for a pressman's job, because pressmen commonly contact various cuts of naphtha and turpentine to clean their presses. Such solvents are both irritants and sensitizers to the skin—they are common causes of industrial contact eruptions. On his initial visit he had substances for patch testing but it was deemed advisable not to test such a boy even with the most dilute solutions of solvents. To do so, even with such dilutions, might precipitate a severe dermatitis. A man with such fragile skin can be useful in the receiving room or shipping rooms, or in the office, or in a host of other jobs. An alert personnel department would have easily screened this boy on his initial interview.

It is well known that those who have once suffered from acne or pimples are prone to develop oil folliculitis when industrial oils are allowed to saturate their skins. Girls should be especially protected, for it is often difficult for the dermatologist to decide where the adolescent nonindustrial pimples stop, and where the oil folliculitis begins. Nor is it easy to decide whether a flare-up of an old acne of the face is due to indiscretions in diet or cosmetics, or whether the exposure to oil has precipitated the condition. In some states aggravation of a pre-existing condition is not compensable, but in Massachusetts, such aggravation is considered to be industry's problem, and here again personnel must be aware of the dangers. Care must be exercised, however, lest the patient feel that discrimination is being effected when employment is refused on such dermatological grounds.

Workers who have suffered with athlete's foot of the soles are prone to develop vesicular eruptions of the hands—both with exposure in industry and without such exposure. It is very difficult and usually impossible to truly evaluate whether the eruption is or is not due to his work. Many veterans from plating establishments, restaurants, leather tanning factories, and other similar water-using places have been seen with vesicular eruptions of the hands allegedly caused by their wet work. So many of these have had previous athlete's foot of the soles that it is now my custom to recommend to young men that they seek dry jobs when once they have had a severe bout of dermatophytosis. It is the rule that the

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eruptions of the hands in these workers has been associated with a flare-up of the original condition of their feet. Therapy of the hands is fruitless unless the condition on their feet is also attended. Many of these workers fail to volunteer that their feet are involved and it has been found advisable to tell them without ado to take off their shoes and stockings. Asking direct questions about a rash on their feet often brings an evasive answer. It is the custom to look first and to ask questions afterwards.

There can be little dispute with the above remarks but the following ideas are not acceptable to all industrial students. It has been my experience that workers who have once had atopic neurodermatitis (allergic eczema) are prone to develop contact eruptions. Not only do they develop contact eruptions more frequently than normal people but such contact eruptions are much harder to clear up than are the usual contact eruptions in the non-allergic patient. Clinical observation suggests that the contact eruption lowers the skin's immunity to the allergen, be it food, bacteria or pollen, so that the skin, which is now broken down by a contact eruption, at the same time reacts to the internal allergens, and now the eruptions continue, not from the contactant, but from the internal factor.

The factor of multiple external irritants also must frequently be considered. A recent patient's naphtha eruption healed only when he stopped wearing woolen clothing. He had a positive patch test to both diluted naphtha and to wool. A second case, involving a man working in a woolen mill, who had a reportedly positive patch test to wool, was seen after two years of specialist care, for an opinion as to the protracted nature of his eruption. On the initial office visit, he was wearing woolen underwear, a woolen suit, a woolen tie, woolen gloves and a woolen overcoat. It is probable that one of these is the cause of his present eruption, and studies along this line are to be carried out.

Recent studies in my office have disclosed that two of the last 20 workers suffering from oil dermatitis also have positive patch tests to wool. This is not the first time that wool sensitivity has been correlated with sensitivity to other substances. It has been reported that the use of benzoyl benzoate in the treatment of scabies, has temporarily at least, sensitized people to wool.

Other combinations are also frequently active. Two patients sealing cartons with water glass were found to have severe erythematous vesicular eruptions of the hands and forearms. Patch tests to the water glass in both cases were negative, but when the water glass was wetted with a dilute solution of the granular soap used by the workers as a hand cleaner, then severe vesicular positive patch tests resulted. Patch tests with the diluted soap alone were negative. Both patients were returned to their original jobs, but were provided with an acid reacting type of detergent, and had no further skin trouble. It is believed that the alkaline nature of the soap added to the alkaline water glass were too much for the acid mantle of the skin.

Causes of Dermatoses

AT THIS point we might consider the major causes of industrial eruptions and analyze the data to see if anything can be done about them. A study of the causes of industrial eruptions brings to light that 38% of all the conditions were caused by only four different agents—industrial solvents, oil, trauma and its management, and rubber and its compounds. If to these four, we add three more—namely resins, soaps, and chrome and its compounds, we can account for 50% of all the cases. The remaining 50% are a diversified lot of nonrelated causes ranging from chicken feathers to chewing gum flavors.

Industrial solvents in this series account for 12% of all cases and are the greatest single causative factor. The various cuts of naphtha and turpentine have caused the greatest difficulty. Eruptions from these have been seen in those working in such varied places as printing establishments, machine shops, dry cleaning shops, and lately, a milliner was seen who had used a naphtha to clean a hat and had subsequently developed a dermatitis. It is surprising how many of these eruptions could have been prevented with a little common sense. It seems that no longer can we consider the naphthas innocuous to the skin. They are not specially toxic when inhaled and are relatively cheap and efficient industrial cleaning agents. Yet they cause 12% of all industrial dermatitis cases. Workers and management know that strong acids will burn the skin and in industry when strong acids are used, the processes are safeguarded so that the acid does not get on the worker. Protective aprons, gloves, hoods and other means are taken to protect him; consequently, burns from acids are almost never seen. Yet the solvents are causing 12% of the eruptions and few if any precautions are taken against them. Many of the synthetic rubber gloves and aprons are insoluble in the naphthas and should be used by those working with these substances. Workers frequently complain that they can not use them in their work, but nearly all have become accustomed to them when they found that such use was essential if they were to keep their jobs. Mechanics, machine tool operators, printing pressmen and all others have returned to their jobs wearing the gloves, with no apparent loss of speed or efficiency. Furniture finishers, on the other hand, must use the finger tips to rub the turpentine, alcohol, and stains into the wood. I am aware of no protection for these workers.

Since pressmen and mechanics are most frequently involved in this group it would seem advisable to instruct all trainee mechanics and pressmen to wear impermeable gloves when these solvents are being used. To date, no effective protective creams are available to these workers nor has any less irritant substitute been discovered which will take this solvent's place.

Not only are these solvents used to clean mechanical parts and other things in the shops, but workers nonchalantly use them to clean their skins. There is no need for this. In general, a mixture of a stearate and a sulfonated oil, will effectively remove almost anything that a solvent will remove (except that the oils in contrast to the solvents leave the skin in place). Such a mixture will remove paint, grease, oil, grime and many other types of dirt.

Industrial oils are the second great cause of industrial eruptions and account for 10% of the cases. Commonly they cause burning of the skin by their defatting action, they cause acneform eruptions and eczematized lesions. The insoluble oils give the most trouble. These eruptions can be prevented by the proper selection of workers, by the use of protective creams of the lanolin type, and by education of the workers. Effective skin cleaners should be provided for these workers—not every granular soap removes these oils from the skin. Workers should wash at meal time and before going home. Management should see to it that a minimum of oil be permitted to contact the skin. Oil soaked clothing does not indicate good housekeeping or a well run shop, and the wearer is sooner or later sure to have trouble.

Trauma and its emergency treatment account for the third largest group of cases—seven per cent of the cases. Minor injuries such as scratches, cuts and bruises frequently result in eczematized and pustular eruptions. While some of these are possibly due to the introduction of bacteria into the skin at the time of the trauma, most seem to be due to the local medications applied and to the adhesive tape.

One large plant, previously plagued by such cases, has had no trouble for the past two years. All dressings in this plant, now are made with either plain dry sterile dressings, boric acid solution dressings or a dressing of a 1/1000 solution of a quarternary ammonium compound such as Ceepryn, Zephiran or chloride phemerol. Bandages are applied, no adhesive tape is used, and the worker is advised to apply no medication. This procedure can be safely recommended for minor injuries. No rashes are apt to result from it. Workers should be advised to seek first aid treatment at the plant for minor injuries—home medication frequently do more harm than good.

Rubber and its compounds account for 5% of the cases but there is nothing new to report on these.

Strong soaps, as used by dishwashers, janitors, cleaning women and others, are a common but also a totally unnecessary cause of many dermatitis cases. Common sense dictates that a soap which is designed to remove heavy grease, paint stains and similar dirt is apt to defat and burn the skin. Since elderly people with already dry skin are usually employed at these jobs, a double risk is run. Mechanical mop wringers, scoops for measuring the soap powders, paddles for mixing the solutions and cloth lined rubber gloves should be mandatory. It should be unnecessary to emphasize that the use of strong soap powders in the home often is the agent which prolongs the healing of an otherwise readily curable industrial dermatosis. Married women with young children are frequent offenders in this regard and stern warning should be given them about the use of such soaps if and when they develop an industrial eruption. Similar advice should be given concerning the use of bleaching waters.

Scabies, dermatophytosis, psoriasis, pityriasis rosea and sycosis vulgaris have been the most common nonindustrial eruptions seen for differentiation.

The most interesting case to date is one in which a worker has been receiving compensation for seven years, has allegedly at the same time been working at another job, and gives the history that the eruption she had seven years ago, is the same one that she has off and on even today. No dermatologist had seen this woman. When first seen, no rash was present but she gave a typical story of recurring erysipelatous affection of the leg. Some months later she was found to have a typical picture of this nonindustrial condition, yet she has been industry's problem for seven long years.

Modalities of treatment useful to one man are frequently useless to another—conscious of this, I would like to suggest one or two new things to you. The above mentioned quaternary ammonium compounds are available in 10% concentrations, and are sometimes effective wet compresses for eczematized dermatoses when diluted approximately two teaspoonfuls to a quart of water. They frequently relieve itching and control eczematization. Being bacteriostatics, they should theoretically control secondary infections of dermatosis cases, and such infection is thought to be the cause of the persistence of some cases despite what appears to be adequate therapy.

A second substance, known as G-11, is being used in one of the new cleansing agents, Phisoderm, and seems to hold some promise for the future. As a surgical scrub, this substance is reported to kill all pathogenic bacteria on the surgeon's hands. Theoretically it too should prevent secondary infection and, at the moment, seems to be of benefit in some eczematized contact dermatitis cases. It is still in the experimental stage.

Looking to the future, I believe that industrial eruptions will be in large part prevented just as metabolic poisonings have been prevented. One must realize that the skin was meant to be surrounded by air—anything else, probably even clothing, is foreign to it. As the working area approaches this norm, industrial eruptions will largely disappear.

Silica Bearing Dust

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THE significance of silica bearing dusts in industry depends entirely on the degree of harmful exposure offered to workers during the course of their daily occupations. The most important consideration in any occupational hazard is, "How does it affect the man?" The amount of silica in a material used, the degree of contamination of the atmosphere or the percentage of silica in a dust sample, is of less consequence than the number of finely divided particles that actually reach the alveoli or small air sacs of the lungs.

Dusts produced from substances containing silica consist of particles of various size but only those below three microns in diameter (a micron is 1/25,000 of an inch) are believed to be dangerous. This means that most of the "visible" dust is not of as much concern as the particles which are not seen by the naked eye. With this in mind, an appraisal of the silica bearing dusts from the viewpoint of jobs which offer significant exposure or a potential hazard would appear to be more meaningful than a simple listing of dusts which contain silica.

Silica or silicon dioxide (SiO_2) is the most common ingredient (60%) of the rocks and minerals which make up the earth's surface. It exists in two forms, *free* and *combined*. *Free* silica means that the silica is not combined chemically with other substances. *Combined* silica means that the silica is united with certain mineral oxides to form silicates such as mica, clay, asbestos, etc.

As far as is currently known only free silica can cause silicosis but all dusts which contain silica are not necessarily harmful. Silicosis is likely to result only where there is sufficient exposure to dust which contains respirable sized particles of free silica (especially below three microns) over long periods of time (two to 25 years—average 10).

As generally applied, the term *free silica* means quartz but there are many varieties of quartz as well as other forms of free silica.

FORMS OF FREE SILICA

Crystalline (Definite crystal structure)	Cryptocrystalline (Crystal structure too fine to be easily distinguished)	Amorphous (Non-crystalline)
Cristobalite	Chalcedony	*Diatomite
Tridymite	*Flint	*Silica Gel
*Quartz	Jasper	*Vitreous Silica
	*Chert	Opal
	*Tripoli	

*Of greatest industrial importance

CRISTOBALITE: A crystalline form of silica (free), extremely hard and inert chemically, very resistant to heat. Not used as a raw material in industry, but refractory bricks made from quartz or quartzite are altered to cristobalite by high temperatures to which they are exposed.

TRIDYMITE: Similar to Cristobalite.

QUARTZ: The most common and important form of free silica—occurs as a primary constituent of igneous rocks such as granite and as chief component of sandstone and silica sands.

CHALCEDONY: A cryptocrystalline form of silica—heat resistant and chemically inert—differs from flint and chert in the manner in which it fractures. Used primarily as a decorative material.

FLINT: A cryptocrystalline form of silica similar to chalcedony but more opaque and granular. Usually occurs as pebbles or boulders or as thick beds. Dull white to black in color—used as abrasive flint, potters' flint, semi-precious flint (Agate).

CHERT: A cryptocrystalline form of silica known also as "Hornstone." An impure form of flint used in abrasives and tube mill linings in potteries.

JASPER: A cryptocrystalline form of free silica, similar to chalcedony. Very compact and opaque. Colored by impurities (clay and iron oxide)—polishes well and used primarily for decorative purposes.

TRIPOLI: Generally regarded as cryptocrystalline form of silica. Sometimes confused with "tripolite," a species of diatomite obtained from the island of Tripoli in northern Africa. Tripoli is derived from the decomposition of chert or from siliceous limestone from which the calcium carbonate has been leached. Used as an abrasive in soap and scouring powders, for polishing metals, as a filtering agent, wood and paint filler, foundry parting compound and in the pottery industry.

DIATOMITE (Diatomaceous Earth): An amorphous silica, composed chiefly of minute siliceous skeletons of marine or fresh water plants known as diatoms. It is a light, powdery, earthy material with a fine, uniform grain. Sometimes called "infusorial earth" but this is erroneous as infusoria (small animalcules) are seldom present. Used as a mild abrasive in metal polishes, scouring soaps, dentifrices, nail polishes, but principal use is for insulation, filtering, and a decolorizing agent in the manufacture of glues, metallurgical solutions, paints, varnishes, fruit juices and leather tanning.

SILICA GEL: An amorphous form of silica, it is a manufactured substitute for diatomite made from sodium silicate solution by the action of hydrochloric acid. It is a hard glossy material with the appearance of clear quartz and is used as a dehydration and filtration agent. It is used in refrigeration, oil refining and solvent recovery. Research thus far indicates that silica gel does not cause silicosis but until more is known, it should be considered potentially dangerous.

VITREOUS SILICA: An amorphous silica formed by melting quartz and found in nature only as a mineralogical curiosity (e.g., hollow tubes of vitreous silica formed by lightning striking a bank of sand.) Manufactured in two varieties, "fused silica" or "silica glass" (opaque), and "fused quartz" or "quartz glass" (transparent). The manufacturer's name for vitreous silica is "Vitreosil." It is used largely for laboratory and industrial chemical handling equipment. It may contain 99% of free silica.

OPAL: An amorphous form of silica occurring as the result of decomposition of silicate or siliceous rocks. Other than quartz it is probably the most common form in which free silica occurs. It occurs abundantly in the diatomaceous earths. Used as decorative material and to a limited extent as gems. As found in nature, it is usually high in free silica.

SANDSTONE: These are compacted sedimentary rocks of variable color and consistency. They range from friable to firm, according to the strength of the cement between the grains which are composed mostly or wholly of quartz. Used in abrasives manufacturing, building and construction, quarrying, paint, etc.

QUARTZITE: A metamorphic rock derived from sandstone in which the sand grains are cemented by silica. When a sandstone becomes so firmly cemented by deposition of silica that the fracture takes place *through* the grains of quartz sand instead of *around* them, it has become a quartzite. Used in abrasives manufacturing, filtering media, paint, mineral fillers, quarrying and building.

GRANITE: The most important intrusive (not appearing on the surface) igneous (formed from molten masses) rock. It is composed chiefly of quartz (35%) and feldspar but also contains flecks of mica and hornblende. Used extensively in building and construction work and in the monument industry. Also encountered in mining, excavating, drilling, quarrying, etc.

FELDSPAR: These are the most abundant group of minerals. They make up about 80% of the igneous rocks. They are silicates of alumina with lime, soda or potassium. They are very important economic minerals. Most of the annual output in the U. S. A. is consumed in the ceramic industries. On weathering, feldspar changes to clay (Kaolin).

TALC: A hydrous magnesium silicate. When it is mined it may be accompanied by other minerals such as serpentine, dolomite, and tremolite (see "Rubber Industry").

ASBESTOS: (See "Rubber Industry.")

SILICEOUS DUSTS

Industry	Siliceous Materials Used	Occupations Offering Possible Hazard	Remarks
ABRASIVES			
Natural Scouring Soaps Polishing Powders Sand Paper Sand Blasting Metal Buffing Polishing	Flint, chert, quartz, quartzite, sandstone, sand, tripoli, diatomaceous earth — finely ground.	Abrasive making, bed rubbing (Stone), sand blasting, buffing, sanding, planing (Stone), mixing, packing, metal polishing.	Recent investigation has disclosed a new chest condition known as "Shaver's Disease" in the artificial abrasives industry. The principal exposure is from fumes generated in the processing of bauxite in electric furnaces. The fume contains, among other things, a high (25%) percentage of silica, but the condition is not similar to silicosis and is not thought to be due to silica. The actual causative agent has not yet been determined. Practically all grinding wheels are now free of significant amounts of free silica and hence do not offer a silicosis hazard as is still frequently claimed.
Artificial Grinding Wheels, etc.	Traces of silica only from vitrified clay in wheels. Most common artificial abrasives are emery (aluminum oxide) and carborundum (silicon carbide).	Bonding department, periodic kiln unloading.	
CERAMIC			
Potteries Refractories Brick Manufacturing	Feldspar, clay, sand, flint (includes any form of quartz used in ceramic bodies), tripoli, chert, and other amorphous silica.	Making chinaware, earthenware, stoneware, compounding and mixing native clays, grinding and mixing raw materials, crushing, handling, unloading and weighing, glazing, finishing, fettling, kiln operations, making fire brick, silica brick, etc., brick sawing and cutting—furnace operating.	Most of the raw materials used in pottery contain silica in the form of silicates and may in addition contain a little quartz. The slip house, clay shop and bisque departments have the greatest silica hazard, with frit makers and glost kiln workers only slightly less.
Glass (ordinary and optical) Tile Electrical Insulators	Pure quartz sand—massive quartz for optical apparatus.		
CEMENT			
Portland	Contains 19.86% of silicon dioxide (SiO_2) but less than 1% of this is free silica.	No specific silicosis hazard.	While the cement industry is a definitely dusty one, investigation thus far has not shown that actual silicosis is a problem. Lung changes as revealed by x-ray show only increased linear markings similar to that caused by other inert dusts.

Siliceous Dusts (Continued)

Industry	Siliceous Materials Used	Occupations Offering Possible Hazard	Remarks
Chemical			
Acid Tower Linings	Massive quartz or quartzite.	Maintenance, lining.	While there is always a possibility of silicosis developing in workers in this group, the incidence is not high as compared to other industries known to have greater exposures. Cases are apt to be more sporadic. They are included however because of the possible hazard.
Filtering Media	Massive diatomaceous earth and tripoli, sand, finely granular quartz or quartzite, finely ground tripoli.	Quarrying, mining (open pit), handling, packing, mixing.	
Manufacture of Sodium Silicate	Pure pulverized quartz sand, pure tripoli, diatomaceous earth.	Charging, slagging, and various manufacturing processes.	
Manufacture of Silicon Carbide	Pure quartz sand.		
Paint	Finely ground crystalline quartz, quartzite, flint, sandstone, sand, tripoli.		
Mineral Fillers (as wood and rubber)	Finely ground crystalline quartz, quartzite, flint, tripoli, and other types of ground silica.		
Fertilizers			
Insecticides			
Construction	Rock dust, sand, gravel.	Rock drilling, crushing, handling, road surfacing, tunneling, excavating, sand blasting of stone buildings.	Most of this work is done outdoors so that there is less danger of producing silicosis. However, in confined work such as tunneling and rock drilling, the hazard can be great, particularly where operations are conducted in highly siliceous rock.
Diatomaceous Earth	Crude material obtained from large deposits over centuries, of diatoms or small aquatic plants whose skeletons or shells contain silica. The "needle-like" forms of diatoms have commercial value because of their light weight and fluffiness.	Quarrying, open pit mining, making filters, fillers, absorbents, manufacture of fire proofing material, insulators, packing. Used in paint, rubber, plastic moulding and as absorbent for acids, water and impurities.	Workers exposed to straight diatomaceous earth (not calcined) may show evidence of exaggerated linear markings in chest x-rays similar to that of other inert dusts. This is not true silicosis. In those workers exposed to the calcined diatomaceous earth, fibrosis of the lungs is present but this also differs from the nodular shadows seen in silicosis as nodules are not present. Further investigation is indicated.
Foundry			
Steel Iron Non-ferrous	Sand used in molds, dust from siliceous parting compounds, mold wash, etc.	Molding, shaking out, cleaning castings, sand blasting, sand conditioning, cupola patching, ladle lining, mulling, sand handling, crane men, gate burning.	Contrary to popular belief, the incidence of silicosis in the foundry is not particularly high. Certain operations such as shaking out and cleaning castings may produce dangerous concentrations of free silica if not adequately controlled. While molding sand may contain as much as 70% free silica, the sand is moist and contains other materials such as sea coal and various binders so that moulding need not be a dusty operation. Parting compounds which used to consist largely of silica flour have been practically eliminated in foundry operations today and replaced by mineral facing materials which are silica free. Sandblasting, once an extremely hazardous operation, is now carried out under hygienic and safe conditions so that it is no longer a dangerous procedure. There is good evidence to show that the nodular x-ray shadows seen in grinders in the foundry industry, while closely simulating those of silicosis, are really due to "siderosis" or the deposition of iron pigment in the lungs. Iron dust of this type is inert, does not cause silicosis, and does not produce disability.
Glass	See Ceramics.		
Granite	See Stone.		
Insulation	Massive and ground diatomaceous earth. Rock wool.	Manufacture of heat insulation for pipes, boilers, furnaces, kilns, etc. and also of sound insulation in walls and between floors.	See remarks on "Diatomaceous Earth."

SILICEOUS DUSTS (Continued)

Industry	Siliceous Materials Used	Occupations Offering Possible Hazard	Remarks
DECORATIVE MATERIALS Gems Vases Tabletops Statues	Rock crystal, amethyst, rose quartz, citrine quartz, smoky quartz, chrysoprase, agate, chalcedony, opal, onyx, sardonyx, jasper, etc.	Dry cutting, polishing, crushing, grinding.	Semi-precious varieties of siliceous minerals have but little industrial use. The increasingly extensive employment of grindstones made of carborundum, copper, iron, box wood, etc., and enforced hygienic measures for eliminating dust through wet polishing and exhaust ventilation, now makes the danger of silicosis comparatively insignificant in this industry.
METAL GOODS AND MACHINERY	Siliceous materials in dust from abrasives, polishing materials, etc.	Grinding, polishing, dressing grindstones (old types).	The hazard from these operations is not great. Most of the comments under "Foundry" and "Abrasives" apply in this instance.
METALLURGICAL	Moderately pure sand, massive crystalline quartz, sandstone, quartzite, chert.	Making silicon, ferrosilicon and silicon alloys of other metals such as copper. Used as a flux in smelting basic ores.	A potential hazard exists in these operations but the industry is not noted as a silicosis producer.
MINING Hard Rock (All types)	Ore-bearing rock having significant percentages of silica. Seams of siliceous rock in ore bodies, or rock (quartz, chert, jasper) containing veins of metal such as gold.	Drilling, blasting, handling, loading, tunneling.	Mining has long been recognized as possibly the greatest source of silicosis of any of the dusty industries. "Miner's Disease" has been known for centuries. Its association with tuberculosis is well established. The degree of hazard is governed by several factors. These include the percentage of free silica in the dust or rock, the number of respirable sized particles of free silica at the breathing level of the worker, the amount of time actually spent in the various dust concentrations. This is true for all highly siliceous dusts regardless of the industry or operation which produces them. As in other industries where a dust hazard exists, modern hygienic control measures have greatly reduced the risk of silicosis in mining.
POTTERY	See Ceramics.		
QUARRYING	See Stone.		
REFRACTORY	See Ceramics.		
RUBBER	Various silicates such as talc, asbestos, kaolin, etc., which may contain some free silica.	Mixing, measuring, weighing, compounding, coating wires, etc.	Silicates other than asbestos are not thought capable of producing fibrosis of the lungs. Asbestos does not cause silicosis as only free silica is responsible for this disease. Asbestos is a hydrated magnesium silicate which may cause an occupational condition known as "Asbestosis" through a more or less mechanical plugging of the small terminal bronchioles and air sacs of the lungs by asbestos fibres. Talc is also a hydrated magnesium silicate and cases of pneumoconiosis or "dust in the lungs" have been reported in the rubber industry from the use of this material. Generally speaking, however, the problem of actual silicosis is not a significant one in the rubber industry.
SMELTING AND REFINING	Various ores containing siliceous material—slag.	Crushing, mixing, furnace charging, handling.	In the iron and steel manufacturing industries, according to a U. S. Public Health survey in 15 states, 11.6% of the workers were exposed to silica dust. This does not necessarily indicate the severity of the hazard but does point out the need for investigation and control.
STEEL MANUFACTURING	Silica containing brick.	Removing ladle linings, repairing furnace walls.	The number of cases of silicosis in proportion to the number of workers in the industry is small. Many cases discovered in routine examinations are found to have resulted from previous occupations such as mining, refractories, etc. Most of the cases which do occur are among masons lining ladles and repairing furnace walls with silica brick.

SILICEOUS DUSTS (Continued)

Industry	Siliceous Materials Used	Occupations Offering Possible Hazard	Remarks
STONE Quarrying Building Excavating Mining Cutting	Granite, sandstone, ganister (quartzite rock) grindstones.	Rock drilling, crushing, sawing, grinding, polishing, handtool cutting, sand blasting, machine surfacing, blasting, handling, tunneling, granite cutting, monuments, carving, masonry.	Like mining, this industry was one of the most prolific producers of silicosis. The introduction of pneumatic tools (1892) greatly increased the exposure to dusts rich in free silica. A number of these operations are carried on outdoors so that dust concentrations are smaller. However, an incidence of silicosis of 25% has been reported from a granite quarry industry. Modern dust control methods now in use are expected to greatly reduce this figure.
TOBACCO	Quartz.	Processing tobacco leaf, hanging, blending, stemming, cleaning.	Recent studies indicate that the inhalation of free silica and insecticide dust may be of significance in this industry. The free silica content of dusts found in processing plants ranged from 22 to 58%. Further investigation is required.
VITREOUS	Dust from siliceous materials used, e.g., quartz, flint, feldspar, finely ground silicates.	Mixing, spray coating, sand blasting.	In the glaze department in potteries, the glaze making is an intermittent operation which exposes a few men to heavy dust concentrations for a few hours a week. Automatic spraying machines and exhaust ventilation are now coming into general use so that this hazard will be eventually controlled.

Industries Using Silica Bearing Materials

Abrasives (Manufacturing)
(Users of Abrasives)
Brick and Tile (Brick Cutters—Sawing)
Bed Rubbers (Stone)
Bisque Kiln Workers
Blasters—Foundry and Steel
Buffers—Polishing
Burners (Foundry)
Burn Filers
Casting Cleaners (Foundry)
Cement Workers (?)
Ceramic Workers (See Pottery Workers)
Furnace Chargers
Charger (Smelting and Refinery)
Chasers (Steel)
Shippers
Clay and Bisque Makers (Pottery)
Clay Product Workers (Pottery)
Concentrating Mill Workers
Construction Workers
Core Makers (Foundry)
Crane Men (Iron steel—non ferrous)
Crushermen (Clay and Stone)
Cutlery Makers
Diatomaceous Earth Workers
Drillers (Rock—Stone)
Excavation Workers (Construction)
Fertilizer Makers
Flint Workers
Foundry Workers (Assemble)
Fused Quartz Workers
Glass Furnace Workers
Glass Mixers
Glaze Mixers (Pottery)
Grinders
Grinding Wheel Makers
Insecticide Makers
Insulation Workers
Jute Workers
Masons
Miners
Planer Men (Stone)
Polishers and Cleaners
Pneumatic Tool Workers (Quarry and Mining)
Porcelain Makers (Pottery)
Pottery Workers
Pouncers (Felt Hat)
Quarry Men
Quartz Workers
Road Repairing
Rubber Workers
Sand Blasting
Sanders
Sandpaper Makers
Sand Pulverizing
Surveyors (Stone)
Scouring Powder Makers
Scrapers (Foundry)
Silicon Alloy Makers
Slate Workers
Smelters
Soap Abrasive Workers
Sodium Silicate Makers
Stamp Mill Workers
Statuary Workers
Stone (Artificial) Makers
Stone Masons
Stone Workers
Street Repairers
Subway Construction Workers
Tile Makers
Tumbling Barrel Workers
Tunnel Workers
Zinc Smelters and Refiners

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Program of the Atomic Energy Commission for the Use of Radioactive Materials

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ONE OF the health hazards with which we have as yet only slight familiarity is that entailed by the development of various types of radioactive substances. These substances are at present being used chiefly for research purposes in a relatively small number of laboratories, both academic and industrial. Undoubtedly as time goes on and the importance of the radio-isotope as a research tool becomes better realized than it is today, there will be an increasing problem from the public health standpoint with regard to the safe utilization of the various isotopes.

The distribution of the radio-isotopes is growing at a fairly rapid rate, as more and more individuals are becoming interested in them. It is fortunate that this is so, because this will probably be the most important research tool in the field of biology and medicine since the invention of the microscope. It is your responsibility to be sure that the various substances that are being made use of within the areas for which you have responsibility are being safely handled, both with regard to the individuals directly handling them and with regard to the environment.

Since some of the radioactive substances have long half life there is a real problem in the disposal of them after a given experiment is over; others have very short half life and there is no problem of this sort.

The Atomic Energy Commission has taken the view that it was best to have a committee of thoroughly competent individuals, representing the various fields of research, to guide them in the distribution of isotopes.

I might review very briefly for you the procedure that takes place when a given research worker wishes to have isotopes available for the purposes of his research program. First he makes application to the Isotope Division at Oak Ridge. As you know, Dr. Paul C. Aebersold is in charge of that particular work. Dr. Aebersold refers the application to the committee on isotopes, and the committee considers it from several standpoints as to the relative value of the work in case there is a shortage of any particular type of isotope wanted, as to the provisions for proper handling, and the provisions from the standpoint of the health of those who may come in contact with substance from the time it leaves Oak Ridge until the time it is finally disposed of.

This committee on isotopes has a further subcommittee on human application, and if there is to be a utilization of the material in humans there is a detailed study made of this part by the subcommittee on human application as well as the various factors that are established. If the standards for safety, if the standards of competence, if the nature of the problem is such that the isotope committee approves, then allocation of the material is made. The radioactive isotope is shipped in accordance with thoroughly established safety standards that have been worked out together with the I.C.C. In general shipment is made by air because many of the isotopes are fairly short lived. Iodine, which is one of the most commonly used in biology and medicine, is 8.3 days. Radioactive phosphorus is 14.3 days, and so on. This means, then, that there goes out from Oak Ridge, after there has been a satisfactory understanding with the isotope committee that the people know how to use it, a supply of the radioactive isotopes. This supply is practically always in relatively small quantities.

The isotope is always so packaged that there will be no hazard involved in transport, and that hazard has to be figured not only from the standpoint of any photographic film that might be near it, because if it happens to come close to air mail or air express containing film, exposed or unexposed, there is danger of fogging if there are not adequate precautions. The sensitivity of film is far greater than that of humans, so that when the precautions satisfactory for film are met, precautions satisfactory for humans are met many times over in most instances.

The Atomic Energy Commission in working out these standards has relied on the experience gained in the pre-atomic days in part, because you remember these radioactive isotopes are not new substances, many of them, but have been produced slowly to be sure, laboriously, and expensively by the cyclotrons. However, they can be produced so much more cheaply and in so much greater quantity by the chain reacting pile that this has practically displaced the cyclotron in most isotope preparation.

In April, the Atomic Energy Commission went one step further with regard to distribution of these isotopes. Congress last year laid upon the commission the responsibility of working out certain things that it could do to aid in cancer treatment and cancer research, particularly with an eye to the utilization of atomic energy and its by-products, and in accordance with that, beginning April 1 there was made available without charge to qualified investigators, three of the isotopes. These are radioactive sodium, radioactive iodine, and radioactive phosphorus.

Presented at the Tenth Annual Meeting of the AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS, Boston, March 29, 1948.

The reasons that this disease, cancer, was singled out for preferential treatment was not because of any special desire of the commission itself, but rather because of the responsibility that the Congress has placed on it to do something special for cancer. There are other aspects to the cancer problem as well, but this is one that is most pertinent to the subject that we are now considering.

I might say that this radioactive isotope distribution committee is made up of qualified and representative men from various parts of the country. There is representation of the various scientific fields as well.

Now, how do health officers come into this picture? Essentially in this way: The prime responsibility before any of this material can be released rests upon the isotope committee of the A.E.C. If they don't turn the stuff loose, you don't have any problem with regard to it. They plan in turning it loose to be sure that the quantities are such that there is no major hazard involved. They attempt to make sure that there will be adequate instrumentation and adequate guidance by physicists in the safe handling of the materials, and many of the individual universities, because this is largely a university type of project thus far, have made up such rules. I have here the Harvard University set, which is based on the accepted standards for protection from radioactivity and outlines the various types of problems that may arise from the immediate hazard involved for the individual handling the material to the ultimate disposal of the wastes.

At the present time we have at no one point in the various universities doing research in the medical and biological field a significant hazard with regard to this material. When the possibility of such a hazard may arise it will hinge primarily on the scale with which the materials are used, and it is possible, of course, that a number of research workers using material in the same area might appreciably step up the hazard by that very fact, that is, a slight degree of hazard contributed by each of a number might aggravate quite a little. On the other hand, this is the instance in which the best supervision usually holds.

I think as an analogy we might take the situation that exists with regard to certain of the bacteria. A bacteriologist working in, let's say, a university laboratory or at one of the pharmaceutical houses, could send to the Public Health Service Laboratory that is working on a particular bacterium or particular virus and obtain a culture of it for study. The onus for the proper handling of that would be on the individual. He would not get it unless it was assumed that he knew how to take care of the organisms with which he is dealing. He would have to handle it in accordance with rules that have been established to insure safety of all concerned with the handling of the material.

From the practical standpoint I think there is perhaps more hazard with regard to a strain of bacterium or a strain of virus than there is with the isotopes in the quantities in which they are being distributed at the present time. In the material that I have been working with in my own laboratory since 1939, radioactive phosphorus, we have found that the half life is 14.3 days. Short half life is a material aid force. When we have a problem in the disposal of any appreciable amount of the phosphorus, an amount which always is less than the dose that we would have no hesitancy in giving to a patient, that is disposed of by being placed in a watertight, radiation-tight metal container and it is dropped at sea in an area where there is mud in the bottom. A similar procedure is used in some of the laboratories on the west coast.

The theory of dropping it in mud is this: It will settle in the mud, and by the time the container has worn through, the pressure of the sea water above and the gradual geological change that is taking place will probably result in the container itself being imbedded in an impervious shale before there is any leakage of the material from it.

At other places not close to the seacoast a similar problem of disposal exists, and here particular burial grounds have been set apart with due regard to the degree of permeability of the soil, with regard to the quantity that goes into the area, and the solubility of the material. These grounds are all on carefully controlled reservations, so that there is no danger of the materials getting into agricultural products.

There are certain problems that arise with the discharge of wastes from the manufacturing plants of the commission, and there the problem of environmental health comes into play on a two-fold basis: first, from the standpoint of the gaseous wastes, and, second, from the standpoint of the fluid wastes. The gaseous wastes are handled by the approved methods of precipitation, so that a minimum comes out in the stack gas, and then there is a careful meteorologic study in relation to the character and location of the stack, and there are continuous spot checks being made in the areas adjacent to the plants to determine whether or not there has been any local contamination.

In the case of fluid wastes there is a holding of the contaminated material to reduce the half life to the point of safety, and in addition there is a careful dilution worked out, so that there will not be an undue accumulation of waste products downstream from the plant. In the case of the Hanford plant, which goes into the Columbia River, very careful studies are continually being carried out with regard to the possible contamination. Incidentally, more has been learned about the biology of salmon in connection with these studies than had been learned for a long time in the past. Dr. Donaldson, of the University of Washington, working in cooperation with the state of Washington services there and with a group at the Hanford plant, has done

outstanding work in advancing our knowledge of salmon and the various factors which may affect it.

From the standpoint of the public health officers in the various communities that are using these materials, I would think that the soundest approach would be to determine what the proper requirements for safe handling of the given isotope may be, to become acquainted with the person using the material and see whether or not he is living up to the criteria that have been laid down. In that I want to make clear that there is nothing more discouraging to research than the feeling of a police officer continually looking over one's shoulder, and I think that it is important to handle this problem just exactly as you have handled similar problems in the past.

When there has been a man carrying out research work in the field of brucellosis, for example, you have known of the general character of his work. You have known of his general character. You have known what his facilities were, and you have figured whether or not it was a reasonable thing to be going on. This use of isotopes falls more or less into the same category.

The A.E.C. has carefully avoided any system of rigid inspection, because it feels that inspection when it involves the work of research workers is a sure way of impairing that work, indeed, of driving the worker out of the field. However, it is important that the public as a whole should be adequately protected. Your assurance that the public as a whole is being adequately protected stems from the facts: that the isotopes are not given to anyone who is not capable of handling them properly; that the isotopes are shipped in accordance with approved safety standards; that the advice of thoroughly competent individuals is available and is used to determine how the isotopes should be kept while in the laboratory and how they should be disposed of in case they are not needed.

By and large this last is not as great a problem as it sounds in the average laboratory. Because isotopes are scarce things we try to make the best possible use of them, and I don't recall in a number of years' work, more or less sporadic during the war to be sure, with these isotope substances that we had at any time to get rid of an amount larger than an amount that could be safely given to a single man.

One of the points that does have to be considered is the possibility of hazards in relation to the plants of the A.E.C., and these hazards have been carefully studied in each instance by a committee of individuals thoroughly competent for that, and suitable precautions made for meeting the worst thing that could possibly happen at a particular plant. I believe that as we have more people familiar with these substances, more people using them, we will find even better ways than we have now of disposing of surplus material. There is active work going on at the present time in the waste disposal field, and that is one that I think will soon bear fruit.

We do not need to be unduly apprehensive at the present time as to the waste problem other than immediately adjacent to the plants, because as I said the quantities of isotope that are distributed are relatively small. The half lives in most instances are short, and the precautions such that they can be and are being adequately carried out.

I think that it might be of interest to all of you to follow the reports of the isotope distribution which are made in *Science* from time to time by Dr. Aebersold of the isotope group, so that you might know what institutions in your immediate vicinity are making use of these new materials. I hope there will be some mention made of that point, and I would be glad to know whether or not it would be helpful to the state and the municipal health officers to know when isotopes are being distributed to institutions in their immediate areas.

As a whole, I think, as in the case with anything new, there tends to be appreciable emphasis, perhaps over-emphasis, on the risk involved and too little emphasis on the good. I hope the day will come when one thinks instinctively in mentioning atomic energy, not of Hiroshima and Nagasaki, but of the advances that have been made in research laboratories and the good that has been accomplished for mankind either from the direct therapeutic standpoint or from the avenues of research that have now been made available.

Discussion

DR. WARREN'S paper was opened for discussion from the floor. Following are the questions and DR. WARREN'S answers:

DR. LEONARD J. GOLDWATER (Columbia University): I should like to ask DR. WARREN what conditions encountered in medicine are more favorably treated with radioactive isotopes than by any other known therapeutic measures.

DR. WARREN: At the present time that can be very easily answered. There are many of the isotopes that have not yet been explored. So far as I can say at the present time the radioactive phosphorus in the treatment of cyanosis in polycythemia vera. It will produce remissions in some types of acute leukemia, and unfortunately we cannot tell in advance what those types are. Radioactive phosphorus will also prolong the life of some of the cases of chronic leukemia when they will no longer respond to x-ray therapy.

Radioactive iodine, as you know, is picked up as ordinary iodine is, selectively by the thyroid, and it is possible to get a selective internal radiation of the thyroid by this means. There is some exploratory work being done in the treatment of hyperthyroidism by radioactive iodine. Personally I doubt that this will ever be as good as other methods of treatment that we have, but it is something that needs to be thoroughly explored.

Certain forms of cancer in the thyroid will also selectively pick up iodine, both in their primary lesion and in their metastases. Cures have not yet been obtained. Regressions of metastases have been obtained in some instances. I think that we have got to bear in mind that it is probable that we will not have any panacea in using radio-isotopes for

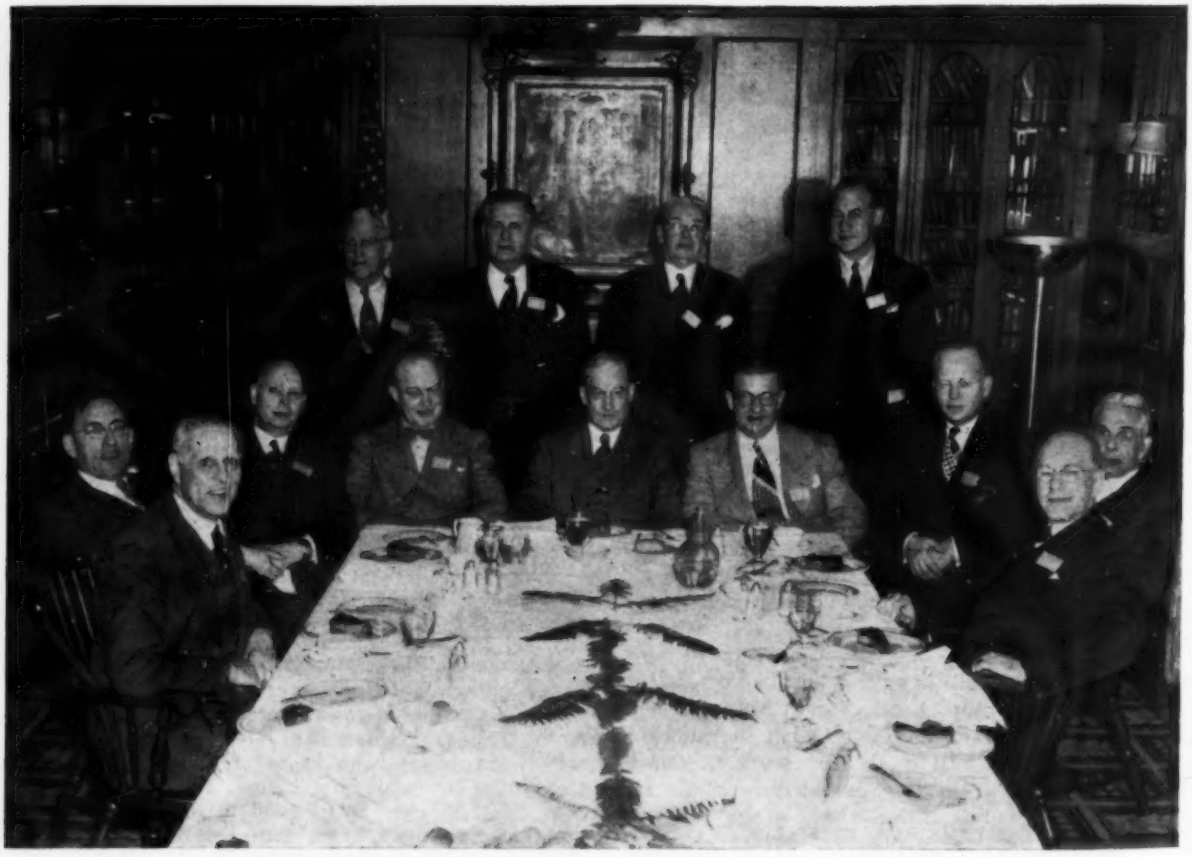
therapy. I doubt very much that there will be any great number of conditions that can be effectively treated by this means. I believe that the chief value of the radio-isotopes in biology and medicine lies as a research tool, as a means of enabling us to determine easily and quickly some of the fundamental biologic processes that have been accessible only by cumbersome and round-about means.

MR. PAUL D. HALLEY (West Virginia State Health Department, Charleston): I think DR. WARREN asked us a question which we at least should answer, and that is whether or not the state health officers would be interested in receiving information as to the research organizations or industries that are receiving radioactive isotopes.

While we don't want to over-emphasize the hazardous nature of this material, I still think that since the state health officer has the responsibility of protecting the health of the workers or of the people, individually as well as in groups, in his state, it is essential or desirable that we have this information, and I should like to say that in West Virginia our Industrial Hygiene Bureau, through the state health commissioner, has requested this information from the Atomic Energy Commission and they have consented to keep us informed of any materials that come into West Virginia.

DR. EMIL CHANLETT (University of North Carolina, Chapel Hill): I should like to ask DR. WARREN whether he believes that any good could be served by having in each of the educational institutions where the use of radioactive isotopes may become widespread at least one individual who would have some degree of specialized training in the field of radioactive hazards to serve as consultant to the various departments of chemistry, biology, zoology, and the like, that might be using the materials, that there might be some individual in each institution who could provide materials and information to them.

DR. WARREN: I think that is a very good point. It may not be necessary in each institution if you have a number of institutions fairly closely located, but you certainly want available within reach someone who has knowledge of the hazard involved. As it stands there is not an entirely adequate number of such individuals at the present time, and in order to meet that need at least in part, Dr. Aebersold, of the Isotope Distribution Committee, has consultants available and there have been a number of them engaged in the health physics work in connection with the various installations of A.E.C., who have been very generous with their time in providing information of the sort that is under discussion.



Meeting of the Past-Presidents of the American Association of Industrial Physicians and Surgeons at the Boston Conference, Tuesday, March 30, 1948

Left to right, standing: Dr. C. D. Selby, Dr. McIver Woody, Dr. T. Lyle Hazlett, Dr. Fred W. Slobe; in order seated: Dr. Royd R. Sayers, Dr. Floyd E. Schaffer, Dr. Edward C. Holmblad, Dr. W. A. Sawyer, Dr. Henry S. Brown, Dr. Harold A. Vonachen, Dr. M. N. Newquist, Dr. Daniel Lynch, Dr. J. J. Wittmer

Left to right: Dr. Daniel L. Lynch, Chairman, Committee on Arrangements; Mary E. Delehanty, R.N., President, American Association of Industrial Nurses; Dr. Harold A. Vonachen, President, American Association of Industrial Physicians and Surgeons; Dr. Frank H. Lahey, Lahey Clinic, Boston; Catherine Dempsey, R.N., General Conference Chairman, A.A.I.N.; Dr. Edward P. Bagg, President, Massachusetts Medical Society

Industrial Medicine and Hygiene

—Abstracts of the Proceedings of the Industrial Health Meetings at Boston, March 27 to April 4, 1948—

Reported by
C. O. SAPPINGTON, M.D., DR. P.H.

THE COMBINED meetings of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS (33rd), AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (9th), AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (10th), AMERICAN ASSOCIATION OF INDUSTRIAL NURSES (6th), and AMERICAN ASSOCIATION OF INDUSTRIAL DENTISTS (5th) included a great variety of subjects and research reports—ranging from the newer problems of handling and disposing of radioactive compounds, alcoholism in industry, to and including also the everyday and ever-present problems of industrial medicine and hygiene.

Beginning with Saturday and Sunday, March 27 and 28, round table discussions were conducted by the AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS for engineers, chemists, nurses, and physicians. Among the subjects of these discussions were experiences with dermatoses; industrial medical education; small plants and industrial nurses; industrial medical administration; the limits of programs of the various industrial hygiene units, and a symposium on ozone.

Monday, March 29—Morning Session

MR. JOSEPH F. MELLOR, JR., and DR. JOSEPH SHILEN presented a study of health hazards incident to extraction of beryllium from beryl and alloy manufacture.

In this study, with respect to the environmental conditions, a measurement was made of the exposure by the impinger collector, using a color reaction, and also the measurement of the fluorides and oxides of nitrogen. Processes and operations were described, with lantern slides, and exposures were determined for beryllium metal, beryllium oxide, and beryllium fluoride, as well as fluorides alone. Exposure to fluoride vapors and fumes was

particularly emphasized; it was found that the oxides of nitrogen were rather high in the plating department, and to some extent in the pickling department. No particular emphasis was placed on the beryllium findings from the engineering point of view.

As to the medical experience, there were no complaints of respiratory symptoms in the beryllium exposures, but there were in the melting or pickling departments. It was thought that some of the employees showed beryllium fluoride effects. No dispensary experience was noted here except one case of dypsnea on account of cardiac disease. With respect to chest films, one foundry worker of 20 years' experience showed some changes, but the other films were negative.

MR. A. N. SETTERLIND gave an outstanding and humorous appraisal of present-day field instruments, emphasizing the limitations of commercial instruments during the past 10 years.

Three qualifications are necessary for proper use: (1) portability; (2) reliability; and (3) sensitivity.

With respect to weight, it should be inversely proportional to the number of samples taken—stationary apparatus should not weigh more than 20 lbs., one swung around the neck not more than 10 lbs., and hand devices should not weigh more than 2 lbs. Apparently only one apparatus at the present time meets all of these qualifications, that being the Bureau of Standards carbon monoxide indicator.

Most of the presently-used apparatus needs modification and improvements and these have been made in a number of instances, as cited by the essayist, including improvements on the big impinger, the carbon monoxide indicator, the electric precipitator, the combustion analyzer, the mercury detector, and the benzol indicator. In a great many respects, it is believed that we are still in the "horse and buggy era," with reference to the use of present-day portable instruments.

DR. CARL F. JORDAN reviewed "Brucellosis in Industry." This paper was published in full in the May, 1948, issue of INDUSTRIAL MEDICINE.

Monday Afternoon—March 29

DR. SHIELDS WARREN outlined the "Program of the Atomic Energy Commission for the Use of Radioactive Materials."

The procedure for the application for isotopes was summarized, and general information was given on durability, handling, and disposal of materials.

After April 1, 1948, radioactive sodium, iodine and phosphorus will be available for research and also for the possibility of treatment of cancer.

Adequate guidance and safety rules have been provided, and the problems of disposal at sea and inland have been discussed in detail.

Information concerning distribution of isotopes can be found periodically in the magazine *Science*.

Thus far radioactive materials have been used mostly for biological exploration and little for treatment.

DR. DUNCAN A. HOLADAY discussed the "Selection and Use of Radiation-Monitoring Instruments."

Since ionization is the effect by which detection is possible, ionization chambers become of great importance as monitoring instruments. These are generally of two types, the electroscope and the Geiger tube, which is a sensitive relay. The pencil dosimeters are the most common form and are best for the measuring of gamma rays, but not for beta rays. The Geiger tube picks up 98% of beta rays, and about 1 to 2% of gamma rays; these must be calibrated and they are especially adapted to detecting small amounts of radiation in water and air.

Photographic films are also valuable, and packets are used in various type of devices; these should also be calibrated.

In using various types of monitoring instruments, one must be able to distinguish between continuous and intermittent processes.

In conclusion, the author humorously referred to the 4th law of thermodynamics: if anything can possibly go wrong at the most inconvenient time, it will.

DR. NORTON CANFIELD discussed "Auditory Trauma from Excessive Noise."

It is important to realize that hearing ability can be altered without the individual realizing it.

Slides demonstrated pathological changes in experimental animals subjected to noise, these changes taking place in the organ of Corti; there was a disintegration of a portion of the organ of Corti in such animals.

The elements of frequency, duration, and intensity must be considered in noise tolerance. An audiogram is not a complete measure of all of these. Fatigue tests may be of value in this connection.

Lantern demonstrations were given of audiograms from the experience of Bunch, in various types of noise exposures, recovery being noted in some instances.

Generally speaking, there are three types of industrial classes, including (1) new employees; (2) those who have been exposed to noise with no resulting permanent damage; and (3) those with permanent damage and loss of hearing.

Group testing is of considerable value in showing those who may be susceptible; ear defenders need a "selling" program, but more important is the use of less noisy operations. Rehabilitation is the responsibility of both industry and society.

DR. HARRIET L. HARDY reviewed the "Medical Aspects of Maximum Allowable Concentrations," particularly with reference to benzol.

Experience predicated upon an exposure of 35 ppm of benzol in the breathing atmosphere in which 16 workers showed abnormal blood pictures, and of which four later continued to be abnormal, was the basis for this discussion; also there was one death case which was thoroughly investigated.

The urine sulphate ratio test was also done with respect to those workers who showed abnormal blood pictures and was correlated with the exposure in the industrial environment.

There was considerable discussion of the possibilities with respect to this experience with emphasis on lowering the maximum allowable concentration as being justifiable.

DRS. GOLDWATER and BRIEGER seemed to disagree with the presentation, whereas DR. GREENBURG agreed with some of the experiences which the present investigation showed, these being similar to those he had had some time ago; finally MR. MALLETTE advised the establishment of normal blood levels before coming to a conclusion that any single blood level might be abnormal.

Tuesday, March 30—Afternoon Session

THIS meeting was a symposium on Radiation Hazards in Industry. DR. C. R. WILLIAMS discussed "Radiation Hazards in Industry," stating that these were really an old problem. The uses of industrial radiography were reviewed, it being stated that the principles were the same in either large or small installations. Practical application was made of these principles in World War I, and it has been found that the portable and fluoroscopic units are probably the most hazardous. Commercial installations are usually harmless and the home-built ones are otherwise. Lantern slides of instruments of various types were shown.

Shoefitting fluoroscopes have been rather carelessly used and it has been found that there is a wide variation in the dose of x-rays to the feet, ranging from 2 to 5 roentgens per second. Also there were problems created by the deflection of rays to other persons, from the instrument. An additional problem came from the leakage from the aperture in which the foot is inserted.

It was advised that x-raying for secreted tools on employees should not be done daily.

As to radiography for testing of materials and structural efficiency, such practices are now well established.

Industrial radium is usually rented, so that the organization may write it off in its expenses, while medical radium is usually owned.

Careless handling is probably one of the greatest problems with respect to misuse of beta radiation.

Experiences were detailed with respect to the use of polonium in spark plugs, thorium in gas mantles, and thoron in excess amounts in certain processes.

DR. R. C. EVANS discussed "Basic Concepts in Nuclear Physics." A few nuclei are "10 to the minus 13 centimeters" in size. Behavior is due to the protons in the nucleus, and various types were illustrated by models. There are about 270 stable isotopes and about 40 radioactive isotopes.

An alteration of the configuration of the protons and neutrons is necessary to produce results and always involved is the ionization of a charged particle.

Actually there are five types of decay which are illustrated by P32, S35, C14, Mn52 and Mn54.

Tissue damage is produced by the freeing of the hydrogen and hydroxyl ions in tissues, which serve to inactivate the enzymes.

Lantern slides were shown of alpha and beta ray tracks during ionization.

DR. J. W. HEALY reviewed experiences in radiation measurements in health physics.

Slides were shown of the various instruments which included monitoring and measuring instruments (ionization chambers—pocket meters—counters, and films).

Detailed descriptions were given of the ionization chamber and of the pocket meter, as well as the counters.

DR. K. Z. MORGAN concluded the session and the symposium discussing "Protection against Radiation Hazards and Maximum Allowable Exposure Values."

The program of continuous education by health physicists has been responsible for the protection of thousands of employees, so that there have been no injuries occurring in these radiation exposures.

With respect to allowable exposure values, at first there were placed at 0.1 to 0.2 roentgens per day—later these were changed to 0.02 roentgens per day for women employees.

Other values have been used as follows: 0.1 microgram set for fixation in the body and 1 millicurie per liter as the air exposure limit.

Lantern slides of various types of operations and protective measures, including pocket meters, badges, and rings were shown.

Wednesday, March 31—Morning Session

THIS meeting followed the introduction of Presidents of the participating convention groups and was a Symposium on Heat Exposure—Physiological and Pathological Effects, Preventive Measures and Treatment.

DR. E. F. ADOLPH opened the symposium, giving a review of the history of heat effects, stating that in 1820 James Johnson referred to the ability of man to adjust himself to his environment, with respect to high temperatures.

The tropical man has the same relative constitution as others, but adapts himself very well.

Apparently there is no limit to sweating; up to three liters an hour has been reported and observations have been made up to two liters an hour; this will be vaporized if the wet bulb temperature is not too high. For practical purposes, one cannot go much above 90° wet bulb and 113 to 114° dry bulb.

Acclimatization is very important and it has been particularly noted that pulse rates and temperatures go up in heated atmospheres, without effort, in unacclimated persons.

Definite relationships have been shown with regard to output in mines, 84° being the optimum temperature.

There has been no standard of warning possible, except temperature. Probably a compound index may be best—one cannot go much above 90° wet bulb when walking, for example. There has been no relation to vitamin intake with respect to heat effects. Training improves, in almost all instances, the ability to withstand high temperature and high humidity.

MR. T. F. HATCH continued the discussion, asking the question "what is the problem in industry?" In some instances, industrialists have said that there was no problem on account of heat, because there has been no death in 15 years' experience. And perhaps this is not unusual because the acute problem so far as heat exposure is concerned has been controlled fairly well by the administration of salt and water. However, the conclusion is not altogether justified, because it ignores other less severe effects. Moreover, standby crews prove that there has been some trouble, because in certain industries it is necessary to have 18 men for three actually at work.

Charts of established accepted zones were shown by lantern slides; below 75° wet bulb effective temperature, no troubles arise—above 88° there is danger. Most actual problems lie between these points. It is quite possible that there are lesser effects that are never discovered.

Lantern slides were shown of curves plotted on psychometric scales of values for easy, difficult and

impossible types of work under certain temperature and humidity conditions. And slides of instruments were also shown including the shielded and ventilated thermometer and the Vernon globe thermometer.

DR. ARLIE V. BOCK concluded the symposium on heat effects, stating that there was a huge amount of data with respect to heat effects which should be made properly available to scientists and the public.

Although there are no tests of physical fitness which one can use, there are certain well-known criteria, such as the pulse, blood pressure, temperature, and various others, and also the possibility of "come-back" may be related to the aorta acting as a pump.

Many factors are involved, including physique, coordination, temperament, rest, habits, acclimatization, diet, alcohol intake, sleep, water intake, and also salt intake. These are all quite important in interpreting the meaning of heat effects, as well as in treating and preventing them.

Wednesday, March 31—Afternoon Session

THE paper on "Alcoholism in Industry" by SELDON D. BACON, PH.D., was printed in full text in the May issue of INDUSTRIAL MEDICINE.

At the session on industrial toxicology, the regular order of the program was changed to allow for setting up an adjustment for the projector, but these abstracts follow the regular program.

DR. H. BRIEGER and associates, commenting on the "Theory and Pathology of Carbon Disulphide Poisoning," stated that all results were negative in exposures varying from 1100 to 300 parts per million, except that of the leukocyte-lymphocytic ratio. The tibial bone marrow showed a few cells and was composed mostly of fat, and there was a normal sternal marrow. A distinction was made between high limited exposures, as in these experiments, and long chronic exposures with low concentrations. There was apparently no effect upon lipase in vitro, but there was decreased enzyme activity in vivo. It was concluded that these experiments leave a number of open questions.

DR. R. M. WATROUS and his co-workers reported on two antimalarial compounds which are really chlorinated tertiary amines, related in formula to the nitrogen mustards. Attention has been drawn to these compounds by some untoward symptoms in the exposed workers. In experimental work, exposure caused vomiting, dilated pupils, and some hemorrhage, with no blood changes except a variation in the lymphocyte counts. A tentative level of 5.7 ppm was suggested. A method was outlined for sampling the air for these compounds. In general, they are considered vesicants and lung irritants, and the dimethyl compound also has a central nervous system effect.

DR. H. B. HODGE discussed "Studies of the Toxicity of Mono and Dimethyl Ethers of Hydroquinone." Interest has been manifested in these compounds because of the absorption of ultraviolet light. Minimal lethal doses for various compounds and animals were established and diet experiments were carried out. Some of the marked effects were enlargement of the spleen and loss of weight in exposure to largest amounts. Dermal tests showed ulceration, inflammation and hyperkeratosis.

J. S. TREON and associates studied the "Physiologic Response in Animals to Respiratory Exposure to Ketene," which has become a valuable acetylating agent. Different species showed great variations in reaction to different amounts, in the highest amounts without fatal pulmonary edema and the lowest causing death—there were variations of 25 to 750 and

Dr. Harold A. Vonachen presenting the 1948 William S. Knudsen Award to Dr. T. Lyle Hazlett

from 50 to 1000 parts per million in the mouse and in the rabbit. In general, there was damage to the lungs and central nervous system irritation. In the dynamic experiments (1 to 50 ppm) for longer periods, there was resemblance to phosgene effects in delayed respiratory action. Ketene was considered to be of the same order of toxicity as phosgene.

V. K. ROWE and associates had conducted toxicological studies on "Some Commercial Silicones." The silicones or organopolysiloxanes have become important because of their properties of heat resistance, being water-repellant, insoluble in water and alkalies, and resistant to oxidation and chemical attack—they are neutral, non-volatile, non-crystallizable compounds, good dielectrics, and inert to micro-organismal attack. In this series of experiments, 13 important compounds were used in oral administration to guinea pigs and rabbits; also used intradermally and intraperitoneally and in the dietary, and introduced into the conjunctival sac.

It was concluded that these compounds have a low order of toxicity as a group, but that repeated

skin contact with solvent compounds should be avoided; no maximum allowable concentrations have been established for the vapors, especially with regard to hexamethyl disiloxane. There is a transitory conjunctival irritation in the eye, but no corneal damage. The finished resins and rubbers are inert.

J. S. TREON and co-workers reported, in a second paper, concerning the "Physiological Response in Animals to Respiratory Exposure to Diisopropylamine." Animal experiments were done with this substance because of reports of visual disturbances and nausea among exposed persons. It was found that the substance is irritant to the mucous membrane and produces pulmonary congestion and edema—the vapors produce a transitory turbidity of the cornea. (The results differ in different species of animals.)

It appears that death was produced by exposing rats to 597 parts per million, in cats to 2207 parts per million—in rabbits and guinea pigs to 261 parts per million. No tentative maximum allowable concentration was proposed, but it was stated that it should be at least under 261 parts per million.

MR. F. S. MALLETTE concluding the session on industrial toxicology, discussed "Toxicity and Skin Effects of Certain Activators, Anti-oxidants and Accelerators." Data were presented on single dose toxicity and effects on the skin, of the more common compounds. Translation of laboratory information to factory personnel protection was discussed, including methods of engineering control and protective equipment. Public contact was also considered. It is hoped that this is the beginning of a systematic study of the compounds used in the rubber and plastic industries, and that similar work will be done by other companies and also by chemical supply manufacturers.

Dr. Fred W. Slobe presenting to Dr. Edward C. Holmblad the A.A.I.P.&S. Award for Distinguished Service

Dr. Daniel L. Lynch, receiving the A.A.I.P.&S. Award for Distinguished Service from Dr. Henry S. Brown

Thursday, April 1—Morning Session

DR. L. E. HAMLIN read the first paper in the absence of DR. H. H. STEINBERG on "Recent Developments in Industrial Health and Hygiene," which was published in full text in INDUSTRIAL MEDICINE, April, 1948.

Two papers followed, by MR. L. DAUTREBANDE and his co-workers, the first one on "The Influence of Liquid Aerosols on Fine Dust Particles." Aerosols are defined as colloidal dispersions of liquid particles in a gaseous medium. These particles show an inability to wet surfaces, stability, small size, slow evaporation rate, tendency to aggregate, and may be bubbled through water without changing the air concentration. Dust particles of a mean size about 0.5 micron behave similarly and are not easily removed from the air. When such dusty atmosphere is mixed with aerosols, there is an attraction for the particles of dust by the aerosol particles and the dust particles become encased in liquid envelopes in masses of 50 or more particles. The implication here is that aerosols might be of value in dust control because of the creation of large aggregates which would probably not reach the pulmonary alveoli; this has been verified in animal experiments.

The second paper of this group, on "The Influence of Dust on the Actual Pulmonary Volume," showed that human experiments indicate that the inhalation of dust produces constriction of the lung and various anatomical structures in it. The inhalation of pneumodilator drugs in aerosol form produces a marked increase of over 1 liter, showing

Dr. James M. Carlisle, receiving from Dr. Henry S. Brown one of the 1948 Citations for Excellence in Medical Authorship

Dr. Edward H. Carleton, receiving from Dr. Henry S. Brown, for Dr. Nathan Millman, the 1948 Citation for Excellence in Medical Authorship awarded to Dr. Millman

that aerosols reach the pulmonary depths, and suggesting that dust constriction can thus be prevented or corrected. It thus appears that the admixture of aerosols with dust would be beneficial to exposed workers.

DR. C. M. JEPHCOTT and his associates reviewed "The Fume Exposure in the Manufacture of Alumina Abrasives from Bauxite," duplicating a great deal of the material which has previously been given at Saranac Lake on the subject of Shaver's disease. The details of the first two fatal cases, with exposure to two and a half to three years was given, with respect to two electric furnacemen. The raw materials contain no free silica, but the fumes were composed of aluminum and silica. The particle sizes are very small, an electron microscope being necessary to measure them. X-ray diffraction and chemical analyses were made, and animal experiments will be carried on in the near future in an attempt to solve the problem.

DR. ALICE HAMILTON concluded this session, giving the Cummings Memorial Lecture on the subject "Forty Years in the Poisonous Trades." This was a classic review dating from 1910 and should be read in the original, which is to be published in full text in a subsequent issue of INDUSTRIAL MEDICINE. A brief will be given here.

Many were the erroneous ideas concerning the contraction of lead poisoning, such as the importance of keeping the skin clean to avoid poisonous effects, that the lead was carried in clothes, and even including Lehmann's idea of swallowing fumes and dust, which was in contra-distinction to Tonquerel des Planches' dictum enunciated more than a century ago that the quickest way to acquire lead poisoning is by breathing finely divided particles of lead metal or compounds. Allusion was made with reference to the reduction of hours of work in mercury mines and the fast turnover of lead workers to avoid trouble, in former industrial experiences.

And lead is still considered more harmful to women, as is benzol, than to men workers. There have been revolutionary changes in the lead industries, good control in potteries, rubber manufacturing, painting, and printing, but lead difficulties "crop up" in new processes, for instance in soldering processes in the auto industries, and scrapping steel with blow torches, as well as in the production of storage batteries.

Other historical developments were detailed—mercury poisoning in hatters, lowered vision following carbon monoxide exposures, use of phosphorus in the match industry which has been completely discontinued for some time, but appeared again in 1923 and in 1946. Foreign experience on aluminum was also discussed. Beryllium problems appear to be on the way to solution.

And with respect to cadmium exposure, the chronic effects are doubtful. Recent pulmonary carcinoma reports from chromium exposure in Germany have been coming in, but of course these need confirmation later.

As to benzol, the greatest advance was made when latex was introduced into the rubber industry; one deviation in the blood picture of an exposed worker is sufficient to make further investigation with regard to benzol exposure.

The nitrogen oxides, the chlorinated hydrocarbons, also present their problems; methyl alcohol is still used; carbon disulphide was first used in the rubber industries, later in viscose manufacturing, and was overlooked at first.

In closing, several statements were impressive: it must be understood that the American Standards Association maximum allowable concentration values are for regular respiration during eight hours of work.

There is considerable variation in the solubility of different types of lead compounds. We must be cautious in applying animal experiments. We must also be careful in insisting upon a "text-book picture" for a diagnosis.

Thursday, April 1—Afternoon Session

DR. G. J. TAYLOR discussed "Health Hazards in Railroad Tunnels," stating that the breakdown of equipment is usually responsible for tunnel hazards. Other factors have been increased traffic and the use of larger engines, with correspondingly increased respiratory hazards.

The work in this survey was done in 28 tunnels, including 1500 temperature readings, and 1200 gas analyses. The basis for temperature was wet bulb of 90 and dry bulb of 105, about one-half the data being above the critical levels.

With regard to sulphur dioxide, the critical level was 20 ppm, median 12, maximum 100; carbon monoxide critical level was 200 ppm, median 40, maximum 1000; nitrogen oxides critical level 30 to 40 ppm, median 23, maximum 60.

It was stated that most trouble arose from the so-called "conventional" type of locomotive. Recommended measures were ventilation systems for fresh air in cabs.

DR. H. B. ELKINS reviewed "The Case for Maximum Allowable Concentrations," referring to a minority of three critics who were critical of terms and values with respect to a previous New England meeting.

Maximum allowable concentration values should be chosen on the basis of experience with exposed employees. Controls should be based on consideration of toxicity, not only on engineering data. One should place more reliance on medical control, but good engineering practices are also important. The argument referring to maximum allowable concentrations is based on meager data versus no maximum allowable concentrations at all. Data from animal experiments are justifiably used.

M. EISENBUD and associates reported on "Environmental Studies in Plants using Beryllium," These studies were limited to the acute phases and it is thought that beryllium ore, beryllium sulphide, fluoride, beryllium ammonium fluoride, beryllium oxide, beryllium carbide, and beryllium oxyfluoride may be significant. It is believed that the oxide, sulphate, fluoride, and metal may be factors in acute effects.

All cases thus far in this experience have been associated with an exposure in excess of 0.4 milligram per cubic meter. These investigators have been using 0.25 as a critical figure for acute effects; there is no figure thus far for chronic effects.

Dr. Jean S. Felton, receiving from Dr. Henry S. Brown one of the 1948 Citations for Excellence in Medical Authorship

DR. J. CHOLAK and co-workers reported on "The Nature and Quantity of Contaminants in the Cincinnati Area (November, 1946, to November, 1947)."

These are rather valuable data and will have significance later when they have been collected over some years. Collections were made in several different areas and neighborhoods and then averages were computed. The dust averaged 250,000 particles per cubic foot and the variation was from 100,000 to 1.6 million particles; lead averaged 0.03 "plus" milligram per 10 cubic meters, the variation being from 0.01 to 0.09 (in street sweepings the percentage of lead varied from 0.05 to 0.75, other metals occurring in very small amounts).

Left to right: Dr. Harold A. Vonachen, Dr. Frank H. Lahey, Dr. Edward C. Holmblad, Dr. Daniel L. Lynch

Fluorine showed a mean of 0.02 milligram per 10 cubic meters. Carbon monoxide showed 10 parts per million in some localities with a maximum of 25 parts per million. Sulphur dioxide varied from 0 to 0.06 in some places and in other places, from 0.02 to 0.25%. The soot fall averaged 37 tons per square mile per month, with a variation of 13 to 144. Free silica showed 3 to 5% in heavy falls.

TWO papers were reported by DR. E. J. LARGENT and his associates, the first on "Urinary Fluoride Excretion and the Roentgenographic Changes Observed in Workmen Engaged in the Manufacture of Inorganic Fluorides." It was possible to get urine samples from 23 workers in two different factories manufacturing inorganic fluorides. The highest figures showed 20 to 28 milligrams per liter in Plant A and 6 to 11 milligrams per liter in Plant B.

In the x-ray study, 16 of 23 persons were x-rayed, one showing a marked increase in density, one moderate, and two slight. The two showing the most of the changes were associated with high fluor-

ine content in the urine, these changes appearing in the spine and the pelvis in the x-rays. A case of a man 72 years showed hypertrophic changes in the spine which was, of course, not occupational. No persons were disabled, in this series. In the discussion there was a question of differential diagnosis between Marie-Strumpell disease and fluorosis.

The second paper by LARGENT and associates was a discussion on "The Absorption and Excretion of Fluorides—Further Observations on the Metabolism of Fluorides at High Levels of Intake." This consisted of experimental administration of fluorides in undissolved state and in solutions to a human subject during two to six weeks periods, 6 to 36 milligrams per day. Absorption of 93 to 98% took place in aqueous solution and 62 to 77% in undissolved salts.

Storage averaged from 1.37 milligrams per liter to 10.83 milligrams per liter per day and urinary fluorine from 3.1 milligrams per liter to 17 milligrams per liter. It was noted that following the last period of ingestion, abnormally large amounts of fluorine were excreted, but they gradually decreased.

Friday, April 2—Morning Session

THIS was a joint meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS and the AMERICAN ASSOCIATION OF INDUSTRIAL NURSES, and took the form of an Industrial Health Forum, with the discussion leader, MARY A. MAHER, R.N., introducing the panel as follows: DR. WARREN PAYNE, Medical Director, Ohio Rubber Company, Willoughby, Ohio; DR. MILTON H. KRONENBERG, Assistant Medical Director, Caterpillar Tractor Company, Peoria, Illinois; ELOISE ZURSTADT, R.N., Briggs Indiana Corporation, Evansville, Indiana; MR. ROBERT CLAIR, Director Safety Education, Liberty Mutual Insurance Company, Boston; LUELLA M. THOMPSON, R.N., General Mills, Inc., Minneapolis; MR. LEO TEPLOW, Assistant Director Research, Industrial Relations Dept., National Association of Manufacturers, New York; and DR. WILLIAM BRICKLEY, Medical Examiner, Suffolk County, Massachusetts.

The highlights of this panel discussion were as follows: there is apparently a great dependence upon the nurse in small groups and there has been little help from management or labor with respect to these relationships.

In some larger groups, emphasis has been placed on complete examination and proper placement with maintenance of a healthy environment, even including laboratory service in analyzing water and milk supplies.

Services were outlined for a small group of approximately 1400 employees in a midwestern state.

In the large industrial organizations, there is a noticeable restriction of nurses' activities almost entirely to professional duties. These professional duties do not vary in different sized plants, but differ only in degree and not in kind.

With respect to accident prevention, the role of the nurse in this field was discussed at length, and a definition of the profession of safety engineering was given. As to production versus accidents, this seems to be a matter of doing the job the right way, and cooperation with engineers.

The medical examiner's work was outlined and it was stated that formerly 60% of the cases were lawbreaking cases, whereas now only 20% are of such cause; it was also stated that occupational diseases present great difficulties. It was advised that the doctor take the responsibility and that reportable cases of various types come under his jurisdiction. Nurses were advised to be discreet and not to pay attention to professional criticism.

In spite of the pleasure of flattery, the job is still the same. Human relations involve intent, but also result in terms of individualized service. The nurse should know about other parts of the industrial relations program and also contribute to facts on which policies are based—these can still be professionally confidential. It is of greater importance to help the foreman and see that he gets credit, rather than the nurse to popularize herself.

In the large industry, the nurse is perhaps more subordinate to the physician, and vice versa. It was thought that, although the medical department is separated from the industrial relations in some plants, this should not be the general practice. It was concluded that standing orders are encouraged and even demanded by the best nurses.

ASSOCIATION NEWS

Directors Meet

THE mid-year Board of Directors' meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS is to start with a luncheon, Monday noon, June 21, 1948, at the Drake Hotel with business continuing until 6:00 P.M. This is the first day of the American Medical Association Chicago Convention, and from present replies, nearly everyone of the Officers and Board of Directors will be present. Reports of the Officers, District Counselors and Chairmen of the various committees will be presented and discussed.

Central State Society

THE CENTRAL STATES SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY meeting, Sunday, May 9, 1948, was very well attended by about 125 members. The presentations were excellent with much informative discussion. It preceded the Illinois State Medical Society meeting and, therefore, many downstate members were able to attend.

New England Conference

WE have information that the NEW ENGLAND CONFERENCE OF INDUSTRIAL PHYSICIANS AND SURGEONS held at the Hotel Bond in Hartford, Connecticut, May 27, 1948, was attended by over 150 physicians with much interest in the worthwhile program presented.

Association of Mine Physicians

ON Saturday, May 8, 1948, DRS. F. W. SLOBE and E. C. HOLMBLAD, representing the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, appeared before the district meeting of the ASSOCIATION OF MINE PHYSICIANS held in Harlan, Kentucky. This was a very valuable meeting with much exchange of comment and opinion regarding the problems of the mine physician as they are presented today. It was gratifying to observe that on a rising vote all of the member-physicians present voted unanimously to approve the application of the ASSOCIATION OF MINE PHYSICIANS for a Component Society status in the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS. Details for the further presentation of this matter to the Board of Directors at its June 21, 1948, meeting are underway. There appears to be splendid opportunity for cooperation between these two groups in the advancement of the specialty field of industrial medicine and surgery.

DR. HERMAN J. FLAX of San Juan, Puerto Rico has been taking some post-graduate work at the University of Pennsylvania School of Medicine. After completing his present studies there, he will spend several weeks visiting clinics and medical departments of industries in and about New York City. Thereafter, he will return to Puerto Rico to resume his work on hand surgery and rehabilitation for the State Insurance Fund of Puerto Rico.

A RECENT note received from DR. OTTO P. GEIER of 2200 Upland, Cincinnati, Ohio, informs us that he and his family are sailing on June 21, to spend several months in Europe, and particularly Switzerland. He wishes to be remembered to all of his friends, who, we are sure, in return, wish him *bon voyage* and much happiness in the enjoyment of his retirement.

DR. CLARK R. W. MAGILL of 4801 W. Chicago Avenue, Chicago, Illinois, was the unfortunate victim of the Memorial holiday automobile accident toll. At about 1:00 A.M. Sunday morning, May 30, he was answering an emergency call to the Garfield Park Hospital in Chicago, when another car drove through a boulevard stop light, causing DR. MAGILL'S death. He was a graduate of the University of Illinois College of Medicine in 1923. He interned at the University hospital in 1923 and 1924, saw much active service in the Army during World War II, and had returned to his industrial medical and surgical practice with renewed vigor and enthusiasm.

WE have only recently learned of the death of DR. A. N. CROUCH of Schenectady, New York, who died on September 24, 1947, of coronary thrombosis at the age of 67 years.

MORE recently we have been informed of the death on April 15, 1948, of DR. JAMES B. WOODRUFF, 513 Monroe St., Rochester, New York.

WE learned from the WESTERN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS about the death of DR. C. A. WALKER, who for the past few years has been an honorary member of this Association. Prior to his retirement as Chief Surgeon of the Southern Pacific Railway, he was very active in industrial medical and surgical practice and gave wisely of his knowledge and experience to the younger men in this specialty field.

NEWS and COMMENT

Nuclear Physics and the Sciences

IN cooperation with the University Medical Schools at Los Angeles and San Francisco, the University of California at Los Angeles, is presenting a course in the Application of Nuclear Physics to the Biological and Medical Sciences, August 2, through August 20, 1948.

The general chairman will be STAFFORD L. WARREN, M.D., Professor of Biophysics and Dean of the School of Medicine, University of California, Los Angeles, California. FRED A. BRYAN, M.D., Associate Clinical Professor of Medicine, also of the School of Medicine at Los Angeles, is director of the course. The program will include the following lectures as well as many laboratory sessions and discussion groups relating to the subjects being studied:

MONDAY, AUGUST 2: Introductory Remarks—Stafford L. Warren M.D. and S. J. Weinberg, M.D.; Units of Measurement and Terminology—Dr. Bryan; Introduction to Atomic and Nuclear Structure—Dr. Cassen.

TUESDAY, AUGUST 3: Introduction to Atomic and Nuclear Structure (Continued)—Dr. Cassen; The Nature of Radioactivity and Properties of Alpha, Beta, and Gamma Rays—Dr. Cassen.

WEDNESDAY, AUGUST 4: The Cyclotron, The Pile, The Linear Accelerator—Dr. Dessauer; Radiation Damage—Dr. Stone.

THURSDAY, AUGUST 5: The Principles of Radiochemistry and Its Applications for Preparation and Isolation of the Artificial Radio-Elements—Dr. Hamilton; Production of Radio-Elements by the Pile—Dr. Dessauer.

FRIDAY, AUGUST 6: The Principles of the Applications of Radioactive Tracers and a Detailed Discussion of the Three Major Tracer Techniques—Dr. Hamilton; Health Protection and Safety—Mr. Silverman.

MONDAY, AUGUST 9: Radiation Detecting and Measuring Instruments—Dr. Cassen; Film Badge Measurement Technique—Dr. Bryan.

TUESDAY, AUGUST 10: Biological Effects of Radiation—Dr. Dowdy; Methods of Dosage Calculation; Availability, Cost, Restrictions in the Use of Radio-Elements—Dr. Bryan.

WEDNESDAY, AUGUST 11: Therapeutic Applications of Radiation—Dr. Dowdy; Use of Radioactive Material in Marine Biology—Dr. Donaldson; The Use of Radioactive Isotopes in Clinical Diagnosis—Dr. Low-Beer.

THURSDAY, AUGUST 12: The Genetic Effects of Radiation—Dr. Bellamy; Techniques and Studies in the Use of Iodine 131—Dr. Fink.

FRIDAY, AUGUST 13: Effects of Radiation on the Hematopoietic System—Dr. Lawrence; Methods and Techniques in the Use of Ionizing Radition in Genetic Studies—Dr. Bellmy.

MONDAY, AUGUST 16: Studies Using Carbon 14; Problems and Difficulties in Its Use—Dr. Mackenzie; Pharmacological Applications of Radio Isotopes—Dr. Haley.

TUESDAY, AUGUST 17: Radioiron as a Tool for Studying the Formation of Hemoglobin and Related Problems—Dr. Copp; Review of the Use of Tracers in the Study of Amino Acids—Dr. West.

WEDNESDAY, AUGUST 18: Radioactive Tracers in the Study of the Physiological Chemistry of Bone—Dr. Copp; Review of Methods and Techniques of Autoradiography—Dr. Cassen.

THURSDAY, AUGUST 19: Metabolism of Iodine 131—Dr. Winzler; Subject to be Announced—Dr. Warren.

FRIDAY, AUGUST 20: The Future Field for the Biologist, Biochemist and Medical Man in the Veterans' Administration and Related Services with Respect to Radioactivity—Dr. Lyon; General Discussion and Question Box—Under the direction of Dr. Bryan; Subject to be Announced—Dr. Fermi.

Professional Advice

A RECENT editorial in INDUSTRIAL MEDICINE had the intriguing title, "Quo Vadis Securitas?" A free and unscholarly translation might read "Where Is Safety Heading?"

The editorial points out gravely that there has been no decrease in industrial accident rates since 1932. This, it says, would seem to indicate that the time-tried methods of accident prevention are up against the law of diminishing returns.

The alleged resistance of safety men to new ideas gets a few punches:

"It is not true of all safety men that 'you can always tell a safety man but you can't tell him much.' Nor is the lag due to marked unwillingness to cooperate. The trouble is probably more in the engineering mind. Trained in the purely tangible, it lacks a certain wider tolerance for the intangible.

"To the medical mind, however, the intangible is the everyday encounter....

"When safety gets ready to learn from medicine, there will be plenty of physicians ready to teach..."

From where we sit, we can detect no reluctance on the part of safety to learn. For more than a quarter century physicians have been addressing safety congresses and regional conferences. A psychologist or psychiatrist at any safety gathering is sure to have a large and attentive audience. Many of the their papers have been published in *National Safety News*.

Blaming lack of progress on the "engineering mind" is an unsound generalization and an oversimplification of the problem. Engineers display as wide a variety of mental and emotional traits as any other group. Few of them think all human problems can be solved with a slide rule.

Most of the smaller plants, whose combined experience has swelled the national accident totals, have contact with a physician only when an employee is seriously injured. Many of them do not have a nurse nor any person responsible for systematic effort to control accidents.

In a few plants, with adequate medical facilities, the company physician is a valued member of the safety team. We are glad to report in this month's leading article the experience of a company whose record has owed much to such teamwork: ("The Medical-Safety Team," by R. RALPH BRESLER, M.D., Chief Plant Physician, Sharp and Dohme, Inc., Philadelphia.)

—Editorial, *National Safety News*, May, 1948.

Complex Simple Fracture

REALIZING that the term "simple fracture" as generally defined is thoroughly inadequate to describe the trauma received in many so-called simple fractures, I have added a new definition to the simple and compound fracture nomenclature, i. e., "complex simple fracture" (Key, J. A., and Conwell, H. E.: The Management of Fractures, Dislocations and Sprains, ed. 4, St. Louis, C. V. Mosby Company, 1946, pp. 41-43.) A complex simple fracture is a fracture which is not compound but which has received severe trauma to either or all of the surrounding soft structures, i. e., skin, muscles, blood vessels and nerves. The bony fragments usually are displaced to a marked degree. "Complex," as defined by "Webster's New International Dictionary," unabridged, is as follows: (1) an assemblage of related things; (2) a whole made up of complicated or interrelated parts. The complex simple fracture should be further described as to the type of bony injury, for example: complex simple fracture (transverse, comminuted, spiral or oblique, as the case may be.) Through personal contacts and correspondence with the personnel of the three National Fracture Committees (American Medical Association, American College of Surgeons and American Academy of Orthopedic Surgeons) with reference to their opinions and the necessity for such new fracture term or definition, there was unanimous agreement that such a definition of complex simple fracture was a necessary one and should be generally accepted and used in its broad meaning. I make an appeal that this new fracture definition or its relative equivalent be used by the members of the medical profession. Besides expressing more adequately the pathologic process in such type fracture it will mean improved records for the hospitals and convey a better description of the fracture to the insurance companies, compensation boards and other related agencies, thereby being of much help to the patient, the physician and every one concerned. I will appreciate any opinion or suggestions relative to the foregoing.

—H. EARLE CONWELL, M.D., Birmingham, Alabama, in *J.A.M.A.*, 135:331, October 25, 1947.

Small Plant Program

WHEN small and middle-size companies in Belleville, New Jersey, decided they could get a better medical deal for themselves and their employees by doing the job as a group, they set up the Belleville Foundation to handle it. Through it, employees enjoy medical care no one company could provide. Here are salient details of the program they have drawn up with doctors of Columbia University. *Facilities:* Unused church in heart of industrial district to be bought and converted into clinic; cost to be amortized and paid off as part of annual operating expenses. Clinic will be equipped for examinations, treatments, physiotherapy, laboratory, x-ray. (No Belleville plant now has x-ray.) *Finances:* To be self-supporting, nonprofit-making. Foundation guarantees finances for two-year tryout. Revenues to come from firms which contract for services on an anuual per-capita basis (about $10 per employee), and from fees for service on a per-case basis from nonsubscribers, for preventive services, examinations, compensation cases. Plants will be urged to use per-capita plan. *Participants:* About 25 plants employing more than 6,000 persons, about half in plants with a dispensary and nurse; none with a full-time doctor. *Organizations:* Foundation trustees have final authority; medical administrative committee sets policy; medical director is executive officer; two advisory boards, one medical, one business, aid administrative committee in respective fields; community council serves as liaison group. *Services:* Treatment of occupational injuries, diagnosis and treatment of occupational diseases; preplacement, periodic, and replacement examinations; recommendations for jobs suited to physical capacities; workmen's compensation cases; supervision of environmental sanitation; health counseling for employees; study remedies for absenteeism; cooperate with family physicians.

—*Modern Industry*, March 15, 1948.

NEW BOOKS

Air Commando Doc

AIR COMMANDO DOC, by LT.-COL. ROBERT COLLIER PAGE, M.C. AUS, as told to LIEUT. ALFRED AIKEN, D.C. AUS, published by Bernard Ackerman, Inc., New York, $2.50.

A CURRENT BOOK section review calls this "the well-told story of a group of flight surgeons battling disease, death, and army conditions in Burma." It is all of that. In "Air Commando Doc" COLONEL ROBERT COLLIER PAGE has presented a thrilling narrative and LT. ALFRED AIKEN wrote it up in interesting style. It is an eye-witness description of an important operation presented from the medical point of view, by a keen flight surgeon. It is an authentic, detailed report covering many problems directly concerning flight surgeons, as well as the numerous special medical problems connected with Project 9, an extremely hazardous military operation, in India and Burma.

COLONEL PAGE gives us the various stages of the medical work connected with this operation from the time of assignment, through the selection of personnel and equipment, the special training for the operation, the planning and the hard work at all stages; the headaches, the various cross-currents of feeling, the inevitable clashes of personalities; the building and maintenance of morale; the will-to-win-through regardless of all obstacles of weather, climate, terrain, adverse environment, enemy action, casualties, etc.; the difficulties of holding well trained personnel; having qualified personnel overlooked when promotions were made. The action of certain "brass" with more authority than common sense, rings true in the account given by COLONEL PAGE.

The outstanding value of preventive medicine, especially against such crippling diseases as malaria and dysentery, has been pointedly demonstrated in this narrative.

All the disappointments, headaches, and setbacks were finally overcome when the hard work and killing tasks bore fruit, and it was possible to report "mission accomplished."

COLONEL PAGE and all his men deserve great credit for doing a grand job in typical American style.

It is also the opinion of the reviewer that "Air Commando Doc" is loaded with fine potential movie material.

—JAMES W. LONG, M.D.

INDUSTRIAL MEDICINE

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Honors Where Honors Due

ELSEWHERE in these pages there is a photographic record of the presentations of Awards and Citations at the 33rd Annual Meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS at Boston on April 1. There were three of the former—the WILLIAM S. KNUDSEN AWARD to DR. T. LYLE HAZLETT, for his achievements "in the educational field of industrial medicine"; an Award of Distinguished Service to DR. EDWARD C. HOLMBLAD, Managing Director of the Association, for his outstanding services to the organization "and to the specialty of occupational medicine and traumatic surgery"; and an Award for Distinguished Service to DR. DANIEL L. LYNCH, "for his pioneering work in the organization of medical service in public utilities industries," and his services in behalf of the Association. Each of these Awards and their circumstances will be more fully mentioned in the series of historically-based personal sketches which is scheduled for early beginning in these columns. The other presentations were "Citations for Excellence in Medical Authorship." These were established in the hope of encouraging the production of more and better articles on industrial medical subjects. They are intended to recognize outstanding excellence "in material and authorship of scientific and administrative contributions to the published literature in the field of industrial medicine and occupational health and hygiene" during the successive years beginning with 1947. The first Citation was given to DR. JEAN S. FELTON for his article "Orienting the New Employee in the Services of the Industrial Health Department" (INDUSTRIAL MEDICINE, November, 1947); the second to DRS. JAMES M. CARLISLE and AUGUSTUS GIBSON for their "Need for Scientific Research in Industrial Medicine" (*Occupational Medicine*, August, 1947); and the third to DR. NATHAN MILLMAN for his "Medical Departments in Small Plants—Layout, Equipment and Cost" (INDUSTRIAL MEDICINE, April, 1947). These Citations are to be given at the AAIP&S Annual Meetings each year, and the field of selection embraces "all published articles on industrial medical subjects in whatever journal."

Alcoholism in Industry

THE First Industrial Conference on Alcoholism, held in Chicago in March of this year, appears to have started something. Prior to its courageous action in facing the fact that alcoholism *is* a problem in industry, and bringing that problem into the open for frank discussion, the subject seemed borne down in an atmosphere of "hush, hush"—almost taboo. Since the Conference, however, there's a different attitude—evidenced by frank and frequent discussion in meetings, in the current press, and in the medical literature. This, of course, may be merely coincidence, but we prefer to believe the Chicago Conference had a very great deal to do with the newer thought that is now spreading so wisely and so well. The Conference was announced as the first organized recognition of the problem from the standpoint of industry, and the first seriously planned approach from other than a moral or religious direction. The emphasis was on the *medical* definition of alcoholism and the medical and psychiatric treatment of it. The many in attendance—industrial physicians, executives, personnel officers—found their expectations fully sustained in a series of magnificent presentations. Two of the papers have been published in these pages—DR. SELIGER'S "A Psychiatrist Looks at the Causes of Alcoholism," and DR. NORRIS' "Cost and Remedy of the Alcoholic Hangover in Industry," in our April issue. These and all the others are included in a complete reprint of the Conference proceedings which is now available. This is a beginning textbook, invaluable to every industrial executive and medical director who is bothered by the question of how he can help someone in his organization without getting too far involved in what is personal and what isn't. The printed proceedings may be secured from Industrial Conference on Alcoholism, 8 South Dearborn St., Chicago 3.

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COMMENT and OPINION

Sickness Insurance Flaws

EIGHT objections are charged to the cash sickness insurance system of Rhode Island by Reuben Peterson, Jr., General Manager of the Associated Industries of Rhode Island, Inc., in a letter to the New Jersey Chamber of Commerce. Rhode Island was the first of the two states which pay workers during illness much as they do during unemployment. This was effected by transferring the tax for jobless insurance which the workers still paid to cash sickness or disability insurance. California followed, and now a similar transfer of the employee tax is being considered in New Jersey, one of the two remaining states where employees continue to be taxed for unemployment insurance. In all the other states the taxes for jobless insurance are carried entirely by the employers. Giving the viewpoint of the manufacturers' association of Rhode Island, Mr. Peterson, its General Manager, cited what he termed the following drawbacks to the Rhode Island cash sickness insurance system: "(1) It is a form of state socialism and as such is opposed not only by industry, but by the medical profession. (2) It allows for a duplication of payment for workmen's compensation and from the cash sickness fund simultaneously. (3) It is a temptation to employees to increase absences from work, to the malingerer to stay home and draw pay, to the quack doctor to increase his clients by making a racket of the law. (4) Insurance companies report that it has increased workmen's compensation costs in Rhode Island. (5) It has never been safely and soundly solvent. (6) Once 'on the books' it is hard to improve the law and there is danger that amendments may be passed that will make the law even more unsound. (7) The law is so cloaked in secrecy that the employer has no opportunity to know who in his employ is the malingerer and who is honestly drawing his compensation. (8) Although labor is footing the bill to start with, industry may be asked to 'kick in' if the fund is threatened with permanent insolvency." Enlarging on these points Mr. Peterson said: "The greatest cause for the evils that have pursued this act in Rhode Island lies in the fact that provision was made that, in case of injuries from industrial accidents, the person applying for cash sickness should be allowed both workmen's compensation and cash sickness payments. Many of our plants have long established group insurance plans, which added one more payment to the person drawing cash sickness. A case which has become a

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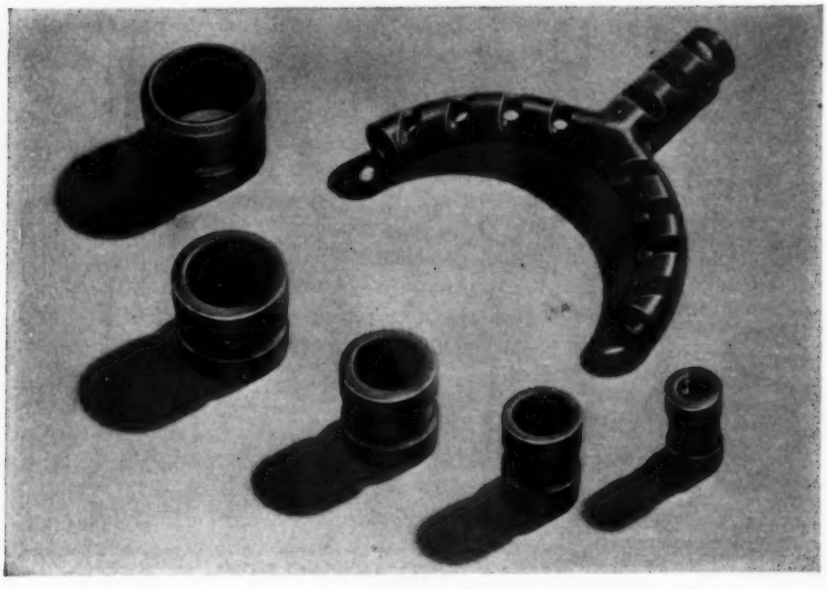

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**See Alesen, L. A.: "A Safety Factor in Gastric Resection." Surgery, XIX (1946), No. 2, pp. 220-222.*

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classic is that of a woman in the Builders Iron Foundry, Providence, who quit work because of a lame back. Her wage when working was, after deductions, $27 a week. When she stopped work she received from the combination of workmen's compensation, cash sickness and group insurance $47 a week, all of which was tax exempt. This maximum was paid for 13 weeks, when the group insurance payments ended; in another 13 weeks it was further reduced by the end of cash sickness payments; the workmen's compensation payments may run for a total of 1,000 weeks. Both the Director of Labor and members of our Unemployment Compensation Board have reported that at times the act opens the door to the quack doctor to increase his clients by signing sickness slips at '$2.00 (or less) per.' Simultaneously there has been a tendency on the part of some employees to reason: 'The fund is being raided; my money is in there; I'd be a sucker not to get anything out of it before it is gone.' Admitting these evils, it is only fair to point out that these charges apply to only a small percentage of those who pay into the fund. Most employees pay their share and use it only when there is a case of real sickness. Likewise only a small number of doctors are guilty of making a racket out of the law. The fund is administered by men of integrity and good character. On the Unemployment Compensation Board staff are qualified doctors to examine those suspected of malingering, but in spite of this, it is difficult to eliminate the chiseler. The fund from the beginning has never been in a safe and sound position. Another outstanding weakness, in addition to tieing cash sickness payments to those of workmen's compensation, is the secrecy with which cash sickness is surrounded. Employers are not entitled to know which of their employees have sought cash sickness payments."

—*Christian Science Monitor*, April 14, 1948.

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Help to Industry

DR. JOHN J. WITTMER, assistant vice-president of the Consolidated Edison Company and one of 10 speakers on a day-long conference on administrative problems in industrial medicine at Columbia University, described the general opinion of the group when he declared: "I firmly believe that industry will tangibly get back in increased production all money and effort that has been put into competent medical service." Dr. Wittmer said industry "should not only consider that it has a responsibility for worker health, but should be eager to take every possible step to obtain it. Emphatically, industry cannot afford to do otherwise." This was stressed by other speakers, who also described plans and procedures for setting up industrial medical service. Mrs. Norma Naughton, president of the New York local of the American Union of Telephone Workers, CIO, declared that an industrial medicine program should provide emergency care for the injured, a long-range plan for the prevention of occupational disease, workmen's compensation and re-

habilitation and research activities. Employers have raised objections against all types of industrial medical programs, but the objections are shortsighted, Mrs. Naughton said. "Industrial medicine and health and welfare plans have become fundamental needs," she asserted. "They are here to stay and labor recognizing its share of the job of administering these plans, will not be found lacking."

—*New York Times*, May 6, 1948.

150 Years Possible

IT'S NOT illogical to predict that man some day will live to be 150 years old, says Dr. A. C. Ivy, University of Illinois physiologist. Within the last four decades, longevity has shot up more than 35%—to almost 66 years—and there is enough medical knowledge at hand, if applied, to raise that figure to 75, he adds. This assault on Father Time calls for new standards in evaluating age, Ivy contends Society's arbitrary demarcations — voting age, 21; productive decline, 40; retirement, 65—are not proper milestones of a change in ability to function in a social role. How old you are at any given moment is a combination of psychological, genetic and biological factors, he says. This explains why some people are old at 30 and others young at 70. The psychological factor is largely an attitude of mind, Ivy says. It includes freedom from worry. A study of 2,000 persons over 90 showed their outstanding trait to be a placid temperament. "Hard work is not a factor, but worry over work is," he asserts. Another psychological element is an ambition and incentive for working and making a contribution, Ivy believes. For this reason, he believes John L. Lewis' retirement plan may be a curse in disguise for many mine workers who, retiring abruptly at 62 after a vigorously active life, will be signing an early death warrant. "I want to make it clear that I am in favor of pension plans, but the determination of the age of a man's retirement should be made by the medical department of an industry," says Ivy, "nothing hastens old age more than idleness. The best antiseptic against senile decay is active interest in human affairs."

—*New York Post*, April 21, 1948.

Fire Extinguishers

AN EXPERT witness, called to refute earlier testimony that carbon tetrachloride fire extinguishers used on Long Island R. R. trains are harmful, testified before a Public Service Commission hearing that phosgene gas, product of such extinguishers, "is very definitely toxic in sufficient concentration." The witness, who appeared for the railroad at the commission's hearing into L. I. R. R. operation,

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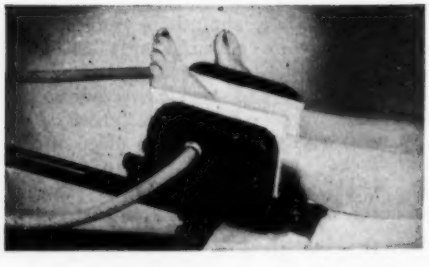

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[1] "Fundamentals of Physical Medicine of Interest to General Practitioners," Hovarth, J.A.M.A. 136:9 (Feb. 28) 1948.

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was Dr. Henry Smythe, a specialist in industrial medicine. Paul Tison, L. I. R. R. attorney, asked Dr. Smythe what effect phosgene gas thus produced would have on people. The witness replied: "It might very readily be definitely harmful, but not cause any serious harm." Smythe said he didn't believe the extinguishers would generate enough phosgene gas to be harmful. "Before the phosgene," he said, "hydrochloride is generated first. This is unpleasant enough to drive people away. If they suffered any serious harm it would be from the hydrochloric acid."

—*New York Post*, May 13, 1948.

Occupational Cancer

THE little-known subject of occupational cancer hazards will be studied in the new environmental cancer section of the National Cancer Institute's control program, Federal Security Administrator, Oscar R. Ewing announced today. DR. W. C. HUEPER, recognized authority on occupational cancer, has just assumed his duties as chief of the new section at the Institute in Bethesda, Maryland. "Since the end of the 18th century when a British physician first noted the high incidence of skin cancer among London chimney sweeps, it has been suspected that prolonged contact with certain chemical substances may be an important factor in causing acme cancer growths," DR. HUEPER said. "A number of chemicals have been definitely shown to cause cancer in mice and other experimental animals. More recently, we have learned to protect workers handling radioactive materials, x-ray equipment, and certain carcinogenic chemicals, from the dangers of cancer and other harmful effects. To date, there has been relatively little systematic study of such carcinogenic or cancer-causing factors in industry, and there is great need for more exact information as to how workers can be protected against these possible dangers. It seems clear, however, that part of the increased incidence of cancer is linked to the growth of industry during the past 100 years and to the dangers of prolonged exposure to certain substances. The first step in the new environmental cancer control program was made last month when $32,694 was granted to the Roswell Park Memorial Institute at Buffalo, New York, for a study of possible occupational cancer causes among the male patients coming to the Institute for treatment. Once a cancer-causing factor has been definitely established, it will be possible to find ways of protecting workers in affected industries. In addition to the Roswell Park survey and other projected studies, the new program includes establishment of an occupational cancer research laboratory at Georgetown University Medical School where members of the National Cancer Institute staff and other investigators can study environmental factors in cancer. DR. HUEPER comes to the National Cancer Institute from the Warner Institute for Therapeutic Research in New York City, where he was assistant director and principal path-

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ologist. Also, DR. HUEPER will be available to serve as consultant to state and local health departments and industrial hygiene commissions.

DR. PILGRIM

CONTINUING with various activities, including periodic examinations of men at work in various places and under different conditions . . . . AND welcoming brother BYRON and sister OLGA on their way back from Arizona from vacation, to Detroit, taking them to the South Shore Country Club for lunch and afterward playing "Oklahoma"—and thence to the train; and again to the office with various desk duties. . . . AND enroute to Boston for the combined meetings of industrial physicians, hygienists, nurses, and dentists, and getting on at Englewood, several passengers asking MADAME PILGRIM for information, and greeting DR. JOSEPH HUBATA, of Armour, and also sanitary engineer FLANAGAN of the Public Health Service; and arrived, sitting in on the doctors' conference of the Governmental Industrial Hygienists and much discussion by DRS. PETRIE, HYMAN, CASTBERG, FULTON, GRAY, NASATIR, and SPOLYAR on the subjects of industrial medical education, small plants and industrial nurses, and the duties and administration of industrial hygiene units . . . .AND next day (Easter) to the Gardner Museum to see the flowers, being driven by FRANCES and LUCILLE HUBER, thence to their home in Waban for radio and piano music and supper, with many reminiscences of old times in the School of Public Health at Harvard. . . .AND attending the various sessions and much impressed with SETTERLIND, of the Bureau of Industrial Hygiene of the State Department of Health of Illinois, in his most humorous and outstanding presentation in the morning session of Governmental Industrial Hygienists; and sitting with ARTHUR VORWALD and noting the considerable controversy and discussion raised by DR. HARRIET HARDY'S paper concluding the session; and after the meeting, seeing many new and old faces, including DRS. JOHNS, HEACOCK, WITTMER, and BILL SHEPARD. . . .AND again meeting old friends at the SCHNEIDERS, with reminiscences of 25 years ago in Boston, at their home in Newtonville; and lunching with MANFRED BOWDITCH, DRS. PETERSON and HOLMBLAD, and ROBERT L. ZIEGFELD of the Lead Industries Association (and a cousin of the famous Flo Ziegfeld); and to dinner with BILL SHERMAN, of American Optical, and DR. GLENN GARDINER, of Sears, Roebuck; and enjoying especially seeing DR. ALICE HAMILTON, the dean of American toxicologists (my former professor), and hearing her excellent review given as the DON CUMMINGS MEMORIAL LECTURE on "Forty Years in the Poisonous Trades"; and afterward meeting DR. FRANK GRIFFIN, of Toronto, reminding me of my appearance on the Canadian Medical Association program next June; and later on to DR. DUTCHESS' cocktail party, meeting there old collegemates, COLONEL GREENWELL and lady JANE. . . .AND enroute back to Chicago with MESSRS. STEPAN, WALWORTH and GORDON, with DR. HUBATA, celebrating the close of the convention and playing gin rummy, at which PILGRIM sat in now and then, and later meeting at dinner DRS. CHALMERS and GRAHAM. . . .AND much reading, running across a very interesting

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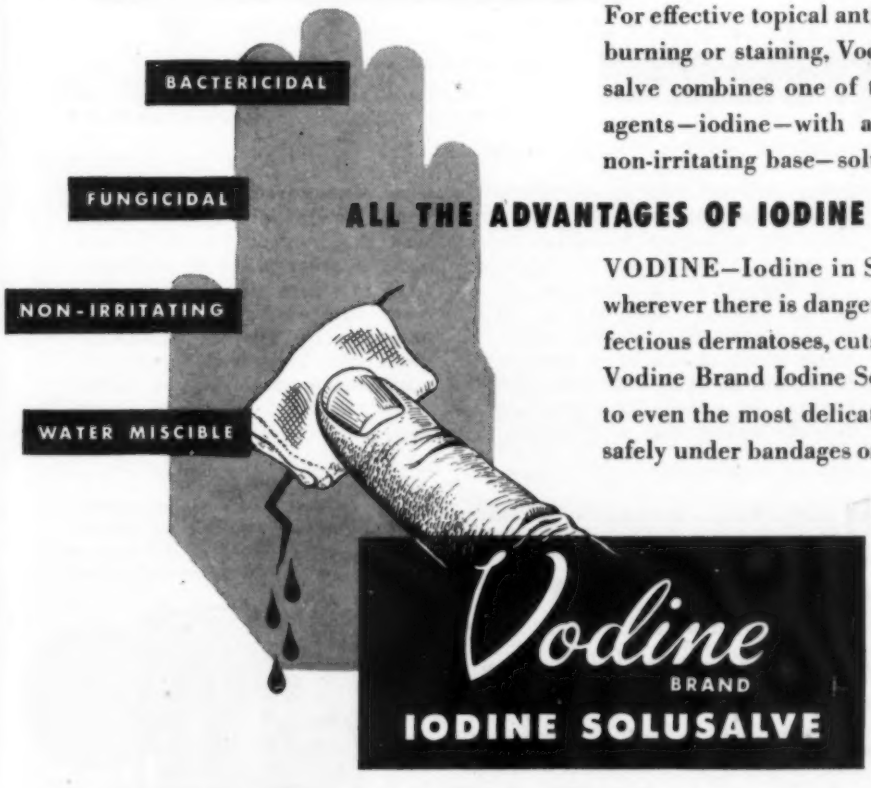
article photostated and sent in by DR. JEAN FELTON, from the *American Journal of Sociology*, March, 1948, and entitled "The Stages of A Medical Career," by Oswald Hall, of McGill University, and wishing that every medical student and intern could read this article, for it is probably one of the best of its kind ever written, the author concluding "It would appear that specialized medicine is no longer an independent profession—a free-lance occupation. It has become highly interdependent rather than independent, and it is carried on within the framework of an elaborate social machinery rather than within a freely competitive milieu. The main contingencies of a medical career hinge on the role which the doctor plays in a very complex, informal organization. Within such a frame of reference there is room for much more research on careers and institutions"....AND at the desk, doing a great deal of work on manuscripts and abstracts, including making special notes on the Boston meeting for reporting at the Chicago Section of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION; and also considering a great deal of literature on health and welfare plans and especially reviewing some of the recent statements concerning these possibilities....AND again again enjoying the radio symphonies on Saturday and Sunday afternoons, particularly the Symphony for Youth by the Los Angeles Philharmonic Orchestra directed by Alfred Wallenstein and the playing of Caucasian Sketches and the Prelude to Deluge by St. Saens; also the New York Philharmonic directed by Bruno Walter, playing with Vladimir Horowitz, this being his 20th anniversary, presenting the Tschaikowsky Piano Concerto No. 1.... AND meanwhile conversing with attorneys and insurance men with respect to another public liability problem in one of the neighboring suburbs, involving a study of gases and fumes, and the writing of abstracts of present opinion and evidence....AND riding to Skokie valley for observations on stack effluent, particularly being concerned with measurements of smoke densities and evaluation of these; and meanwhile enjoying the NBC Symphony in the playing of Rimsky-Korsakoff's Scheherazade....AND enroute to Terre Haute, Indiana, for a hearing, and meeting DR. MALACHI C. TOPPING, and later on being at his home listening especially to some of his records including Lalo's Caprice Espagnole and Capriccio Italienne; and next day in the hearing all day with the discussion of various points both medical and medicolegal as well as industrial exposures, and in the meantime being greatly refreshed by hearing a Heifetz rendition of Beethoven's Concerto in D.... AND speaking at the Chicago Section of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION on a review of the national meeting at Boston, and hearing with considerable interest CARL F. JENSEN talk concerning industrial illumination, and greeting DR. GORDON HARROLD as a guest from Detroit....AND



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to the Gardiner domicile in Oak Park for the weekend, listening to radio and also a great many favorite records, and later trying once more at a game of spots, wherein did quite well....AND noticing the announcement and official invitation to the Ninth International Conference on Industrial Medicine to be held September 13-17, 1948, in London....AND going over some very interesting developments in answer to a request by colleague for progress in industrial medicine and industrial hygiene during the past 25 to 30 years....AND noting in Dale Harrison's column something which should be of interest to industrial hygienists and physicians, in which John Pyskaty reports concerning a plasterer, who, when asked why he roamed from job to job, replied: "It's just the gypsum in me!"—this being another phase of an industrial exposure to innocuous calcium sulphate....AND now preparations for another trip to Indiana with respect to certain administrative problems in industrial medicine, of which more later....

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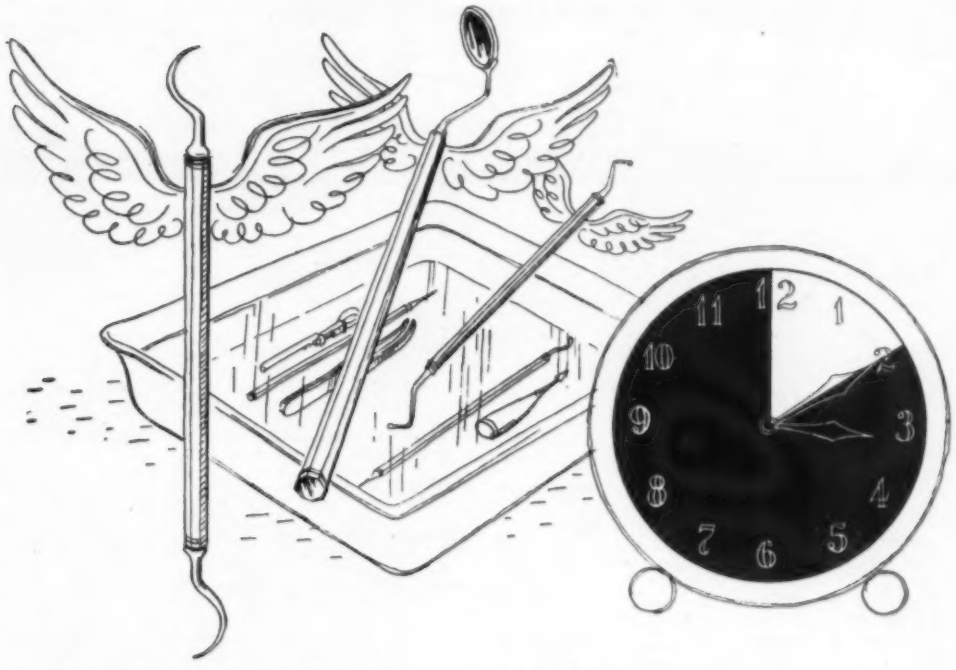

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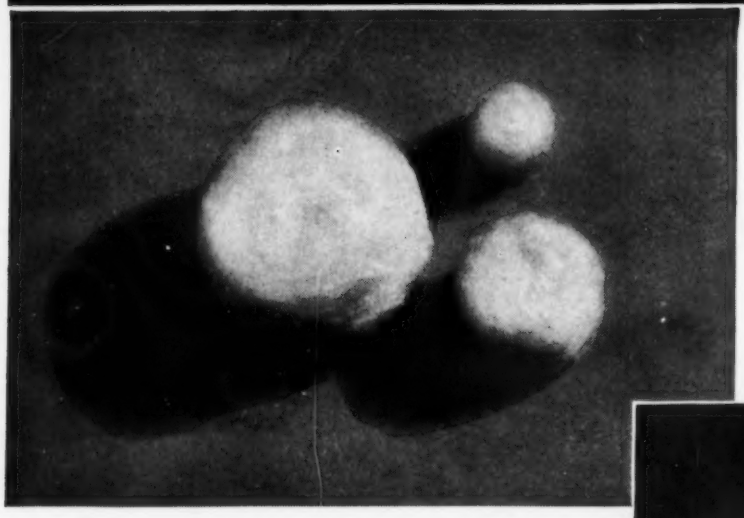

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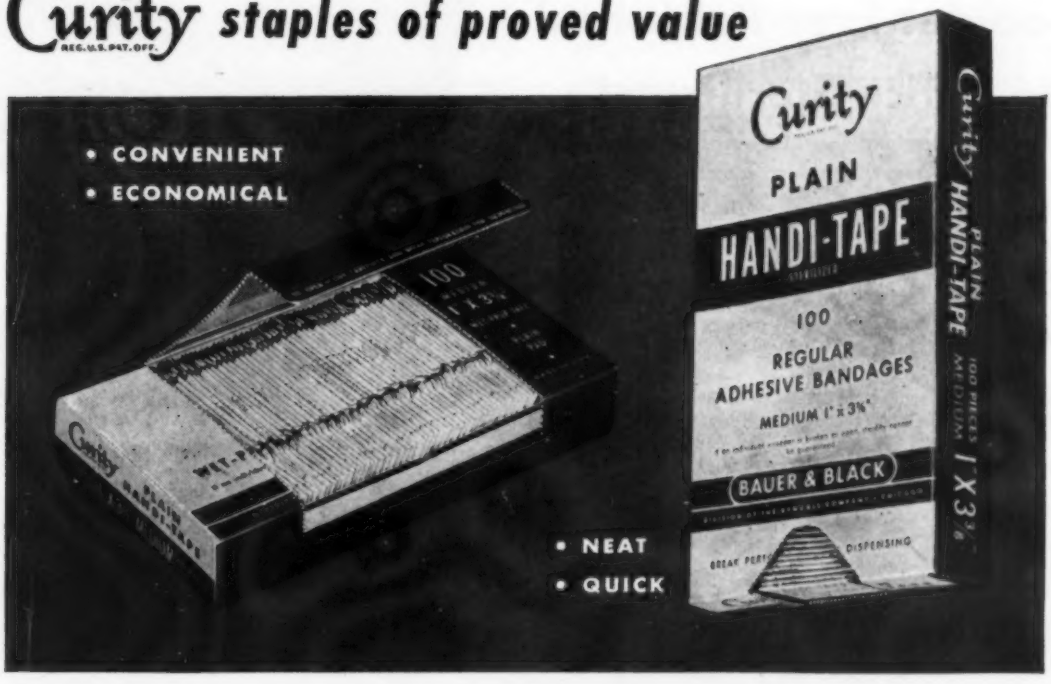

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meets all exacting requirements
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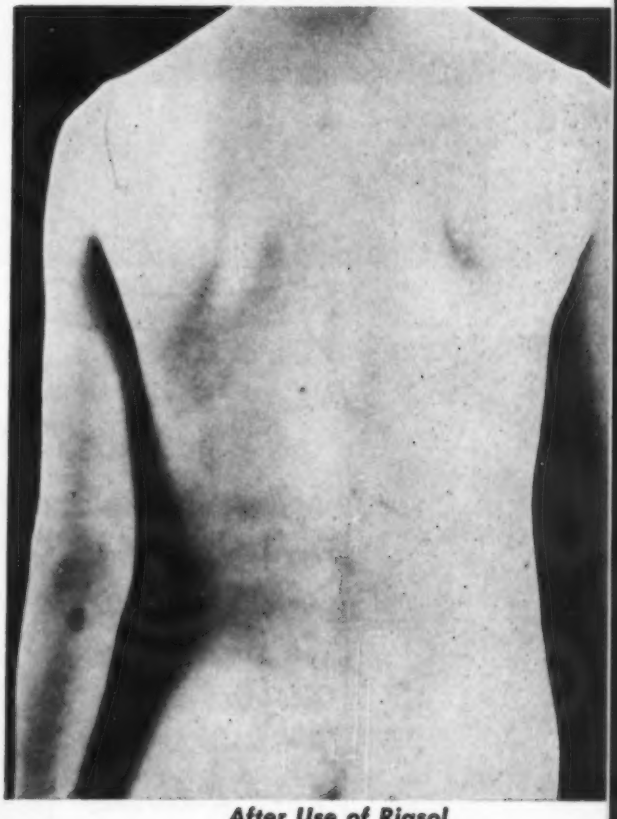

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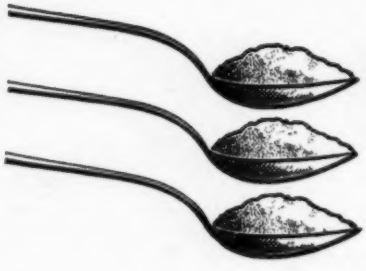

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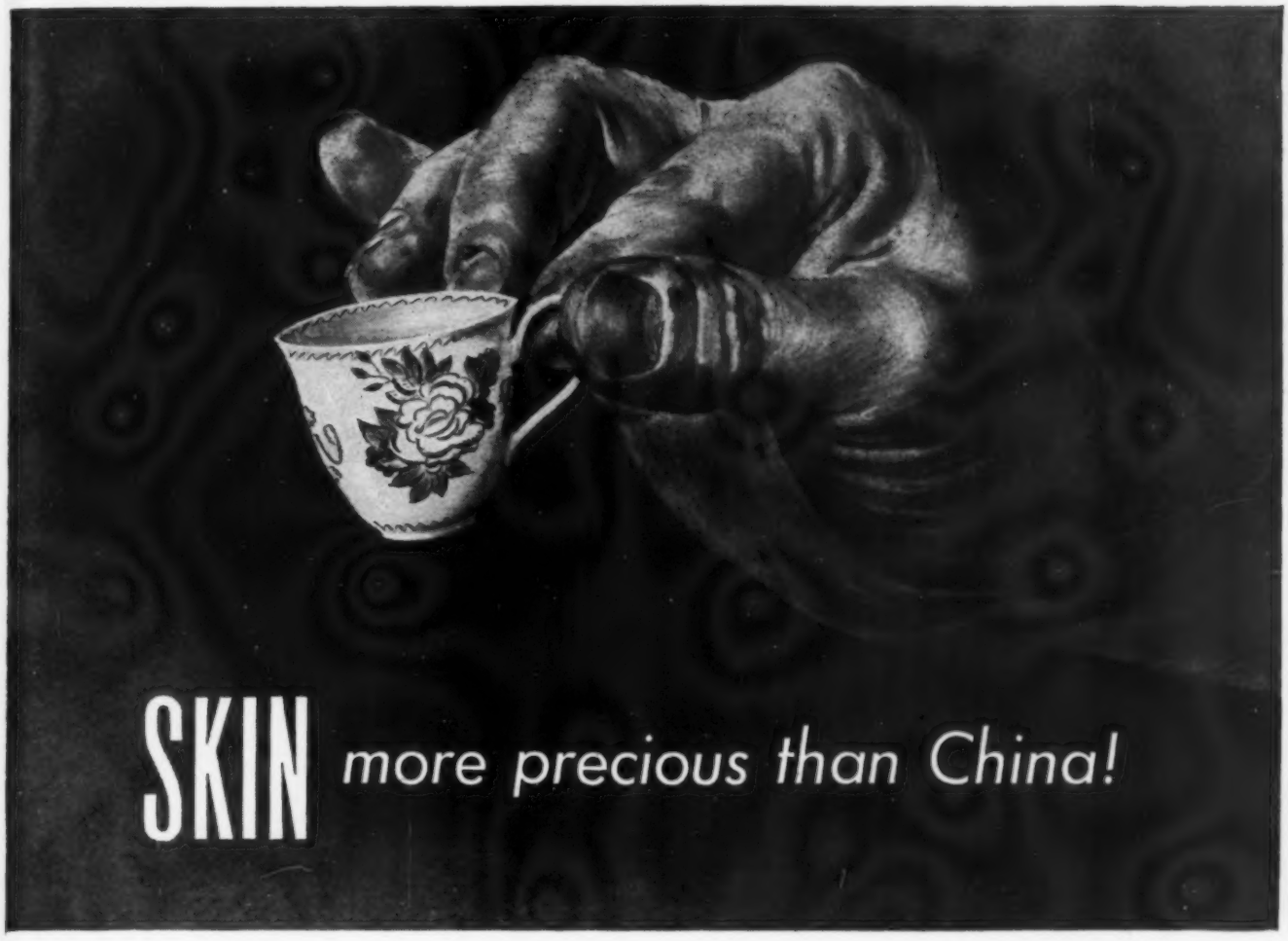

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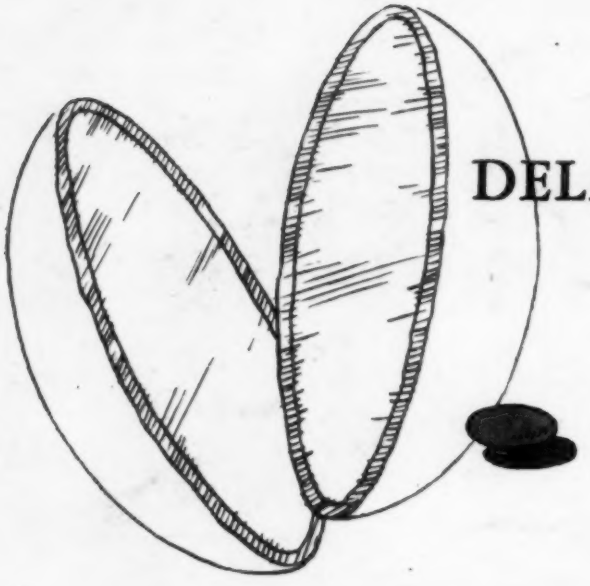

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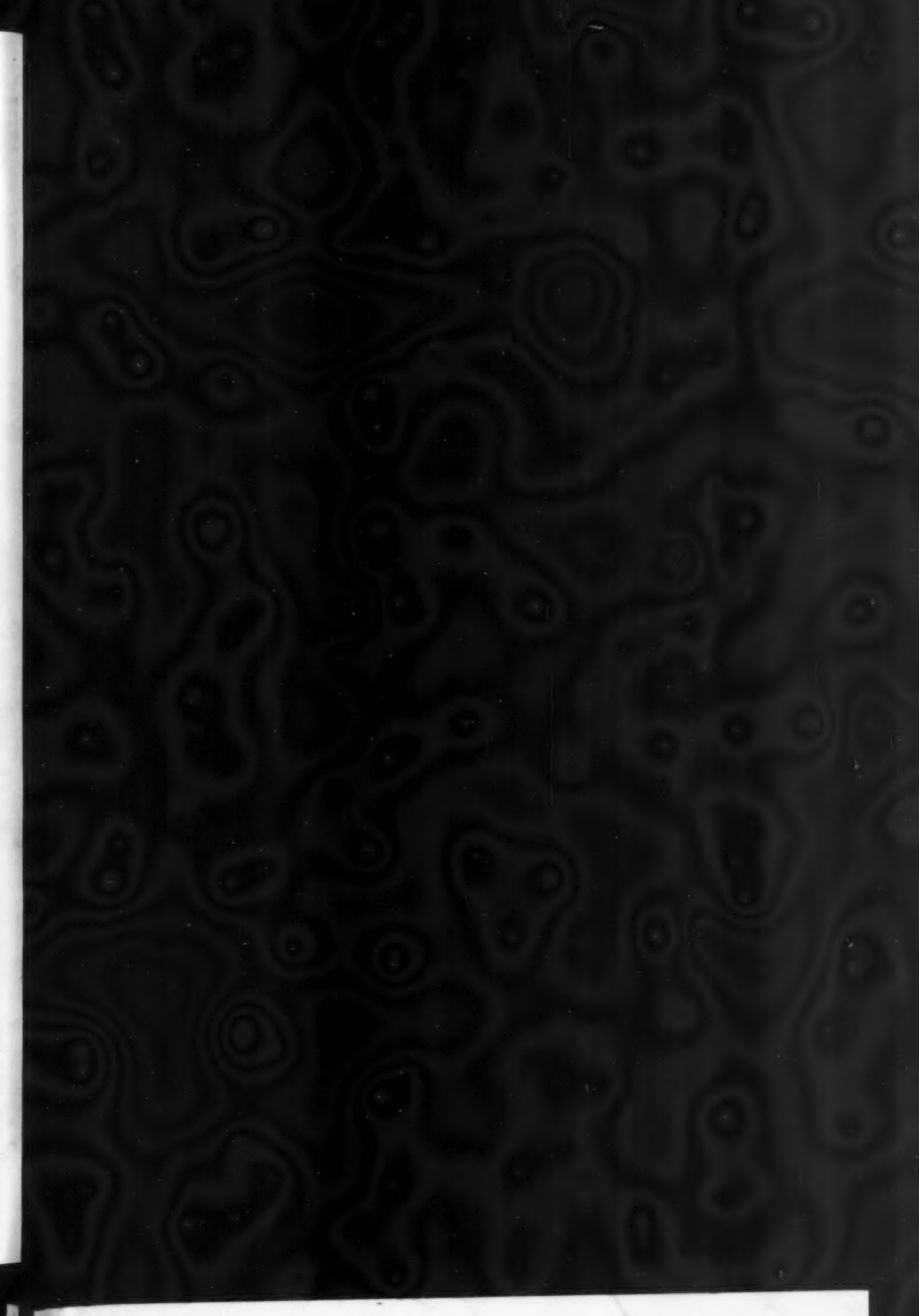
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